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CONTENTS.

PAGE
ADVERTISEMENTS 65
INDEX OF APPLICATIONS FOR PATENTS 65
CARBONIC ACID IN THE ATMOSPHERE 67

REVIEWS—

Bland on the Sun 68
Practical Chemistry 68
Colliery Explosions and Safety Lamps 68
Reviews Postponed 68

CORRESPONDENCE—

Turnbull's Patent 68
PRESERVING FLUID FOR ORGANIC MATTERS 68
COPYRIGHT AND PATENTRIGHT 68
LIGHT UPON REAGENTS, &c. 69
SANITARY ENGINEERING 70
PAGE
EFFECT OF COLD ON BEER 71
SCIENTIFIC SOCIETIES IN AMERICA 71
RECENT AMERICAN AND FOREIGN PATENTS 71
PROCEEDINGS OF THE INSTITUTE 72
MONTHLY NOTICES 72
HORTICULTURAL VALUE OF THE ELECTRIC LIGHT 73

PROCEEDINGS OF SOCIETIES—

Royal Society 74
Geological Society 74
Society of Antiquaries 74
Royal Society of Literature 75
Linnean Society 75
British Archæological Association 76

Societies Continued—

PAGE
Meteorological Society 76
Quekett Microscopical 76
Anthropological Institute 76
Institution of Civil Engineers 76
Microscopical Society 77
Physical Society 77
Chemical Society 77
EXPLOSIVE AGENTS 77
INVENTORS' INSTITUTE 78
USE OF ASPHALT IN ENGINEERING WORKS 78
GAS ECONOMISER 79
HYDROCELLULOSE IN PHOTOGRAPHY 79
MILK IN CHINA 79

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Sculpture, &c.—A. McCallum.

Shears, &c.—C. Kesseler (com.).

Sewing and embroidering.—H. J. Haddan (com.), W. R. Lake (com.)

Ship and Boatbuilding.—B. J. B. Mills (com.), W. R. Lake (com.), J. A. Novello, S. Ward, C. Nicholls.

Ships' Cargoes (Loading, &c.)—E. B. Campbell.

Shot, Shell, Bullets, Cartridges, Percussion Caps, &c.—C. Pieper (com.).

Show Cases, &c.—A. Prior, W. Schofield.

Sifting, Sorting, and Separating.—F. Thompson and W. H. Williamson, E. Davies, A. M. Clark (com.),

Signals, Alarms, Communicating Apparatus, Conveying Sounds.—T. McCulloch and D. Morrison.

Spades, &c.—A. Macdonald, W. R. Lake (com.).

Spinning and Preparing for Spinning. — G. W. von Nawrocki (com.), W. Hartcliffe, W. R. Lake (com.), J. and J. Tattersall, J. Farrar, J. S. Dronsfield, E. J. Couty, T. Gaddum (com.), A. M. Clark (com.), J. Camm.

Spoons, &c.—W. R. Lake (com.).

Springs.—N. Jenkins, W. Edwards.

Stamps (revenue), &c.—L. Engel.

Stays.—E. Langdon, W. H. Symington, J. Ulmer.

Steam and other Boilers, Cleaning and Preventing Incrustation of Boilers, Water Feeding Apparatus for Boilers.—G. Preston, C. H. Roeckwa, R. Langenseipen, S. Dixon, J. McNeil, C. Kesseler (com.), G. Davies (com.).

Steam Engines (Stationary, Locomotive, and Marine).—W. Prowett, J. B. Fell, H. P. Holt and F. W. Crossley, A. M. Clarke (com.), W. R. Lake (com.), C. Kesseler (com.), H. W. Jurisch and J. H. Lewis, P. Jensen (com.), G. Stevenson, P. W. Willans, A. H. Hearington, J. Robb.

Steering Ships and Boats.—W. R. Lake (com.).

Sugar and Syrups Glucose.—W. R. Lake (com.), C. D. Abel (com.), A. E. H. Loge, J. McLaren (com.).

Targets.—R. Mansell.

Tarpulins, &c.—O. Jones.

Teaching, &c.—J. H. Morley and R. C. Hopper, W. R. Lake (com.).

Telegraphs; Telegraph Printing Apparatus.—J. H Johnson (com.), W. R. Lake (com.), G. F. James, O. Heaviside, F. Wirth (com.), G. Wells and A. Gilbert, J. H. Johnson (com.).

Testing Liquids, &c.—G. Budenberg (com.).

Thermometers, &c.—M. Sombart (com.), G. E. Pritchett.

Thrashing Machines, &c.—C. Middleton and P. Everitt.

Threads and Yarns.—G. A. J. Schott.

Tilling and Cultivating, &c.—T. Cooper, A. Macdonell, R. Hancock, E. Loomes.

Tobacco and Snuff, Cigars, Cigar-Holders, Pipe and Cigar-lighters, Smoking Pipes, Tobacco Pouches, &c.—A. Prior, G. Oliver.

Torpedoes, &c.—W. R. Lake (com.).

Toys.—J. Block (com.).

Tramways and Tramway Carriages, Tramway, Locomotives.—J. Livesey, J. B. Carey.

Turning, Lathes for Turning.—W. R. Lake (com.), J. Simpson.

Upholstery.—G. W. Herbert.

Valves, Taps, Stop Cocks, Plugs; Regulating the Flow and Pressure of Fluids.—W. R. Lake (com.), A. M. Clark (com.), J. C. Etchells, J. Shanks and W. Sim, W. Smith, J. Robb.

Velocipedes, Bicycles, &c.—W. Bown and J. H. Hughes, W. Hartcliffe, E. H. Hopkinson, A. and M. Wright, E. H. Hodgkinson, H. Clarke, J. Goodman, W. Soper, W. R. Lake (com.).

Ventilation: Supplying and Purifying Air for Buildings, Mines, Ships, Carriages, &c.—S. S. Hellyer, B. J. B. Mills (com.), W. A. Barlow (com.), J. B. Papier, W. Potts, G. E. Pritchett.

Washing, Cleansing, and Wringing Fabrics, Yarns, and Materials.—W. B. Dick, J. and W. McNaught, J. Whiteford, J. Bell.

Water-Closets, &c.—C. T. H. Brazier, J. Shanks and W. Sim, J. S. Cowe, W. Smith.

Waterproofing, &c.—B. Birnbaum.

Wearing Apparel, &c.—B. Birnbaum, W. A. Barlow (com.), C. T. Mapleston.

Weaving, Braiding, Plaiting, Preparing for Weaving.—D. Armitage, W. S. and R. Collinge, J. Holding, R. S. E. and R. Collinge, C. and T. H. Brigg, J. Hamilton, R. Illingworth, J. H. Johnson (com.).

Weighing, &c.—J. Carr.

Wheels for Carriages, &c.—F. C. Glaser (com.)

Windows and Sashes.—W. P. Bonwick, A. S. Nixon, T. Hyatt, R. H. Thompson.

Wine.—L. Dee.

Wire, Wire Working, &c.—F. James, W. R. Lake (com.), Baron Thurlow, G. Wells and A. Gilbert.

Wood and Veneer.—H. A. V. Wirth.

_ *The above List is prepared from the Patent Records by Mr. T. Morgan, Secretary of the Inventors' Patentright Association, Limited.*

DETERMINATION OF CARBONIC ACID IN THE ATMOSPHERE.

The amount of carbonic acid in the atmosphere out-of-doors varies but little from day to day and from year to year. Indoors it is quite otherwise. In winter we close the windows to keep out the cold air, and in so doing prevent the exit of the impure air poisoned by combustion of coal in the stoves and oil in our lamps, as well as the exhaled effluvia of the breath. To determine the quantity of carbonic acid in a church, school, or theatre is a guide in judging of the success or failure of its ventilation. The usual method consists in drawing a measured quantity of such air through baryta solution and weighing the precipitated carbonate.

Kapusstin has described a quicker and easier method, dependent upon the fact that 70 per cent. alcohol will not dissolve carbonate of soda, while dilute alcohol will do so.

He dissolves ½ gramme of caustic soda in 1 litre of alcohol. He pours 75 c.c. of this solution into a 5 litre bottle full of the air to be tested, shakes it for half an hour, and pours it out, stirs it well, and draws off 25 c.c. of the turbid liquid. To this he adds water from a burette until the turbidity, due to undissolved carbonate of sodium, disappears, and multiplies the amount of the water by three. The following formula now gives the number of cubic centimetres (x) of carbonic acid at normal temperature and pressure contained in 5 litres of air, when n is the number of cubic centimetres of water necessary to dissolve the carbonate of sodium:—

$$x = \frac{n - 6{\cdot}5}{0{\cdot}55}$$

This method is specially recommended for sanitary purposes as the number of determinations made can be very large.—*Scientific American.*

Mr. Orlando H. Jadwin, of New York city, has patented an improvement in the system of car propelling, in which an endless cable of wire rope is made to travel over a given route by the action of stationary engines, and the cars or other bodies are either connected to the cable to be drawn along by it, or are disconnected from it, by means of a clutch affixed to the car. The invention consists in this clutch or tension device, which is loosely connected with the car and formed of three principal parts—a pulley, a foot for holding the rope to the pulley, and a brake upon the opposite side of the pulley from the foot—these parts being arranged in such relation that a pressure of the brake upon the periphery of the pulley projects the pulley against the rope, and gradually clamps the same between the pulley and foot until the car attains the speed of the travelling cable.

Messrs. John Boyd, of Baltimore, Md., and Roy O. Crowley, of New York city, have patented an electrical water indicator for steam boilers, by means of which changes in the height of the water in a steam boiler may operate an electro-magnetic apparatus to open and close the feed water pipe of a steam boiler, to admit and shut off the feed water automatically as required, and to sound an alarm.

Reviews.

"The Disestablishment of the Sun." By John Bland. London: Sprague & Co., 22, Martin's Lane, Cannon-street, E.C. 1880.

This is a shilling pamphlet embodying the views of an investigator who is not content to view things through the ordinary scientific spectacles. We confess ourselves unable to agree with Mr. Bland, although we can fairly say that the arguments he adduces are so cogent that henceforth it will be necessary for those who assert the sun to be wholly and solely the cause of heat, on this planet at least, to carefully study the pages of this pamplet. However, we think Mr. Bland in his zeal to disestablish the sun has gone too far, for to our mind the sun, if not the sole source of heat, is nevertheless the great factor in supplying heat to the earth. Having said this much we are free to add that the work is well worthy of perusal.

"Practical Chemistry;" The Principles of Qualitative Analysis. By Willim A. Tilden, D.Sc. Lond., F.C.S., Professor of Chemistry in Mason's College, Birmingham. London: Longmans, Green, & Co., 1880

Many persons may think that there are quite enough works on chemistry for beginners in existence, still we are inclined to the opinion regarding this little work that it will be found useful to those for whom the author has intended the work.

The book is divided into two parts. In the first the student is required to make himself familiar with the appearance and properties of a few substances with which he will afterwards be constantly dealing. He also learns the use of the blow-pipe. The second part is devoted to analysis.

"An Essay on Colliery Explosions and Safety Lamps. By William Purdy. London: Colliery Guardian Office, 49, Essex Street, Strand, 1880.

In a recent number of the *Scientific Review* will be found a paper read by Mr. Purdy on Colliery Explosions and Safety Lamps before the Inventors' Institute. This little work under review embodies the paper thus read with additional information which will be found valuable to those interested in our coal mines. A detailed description and drawing of Purdy's lamp is given.

"Murby's Melody Piece Book." Compiled by Rev. W. J. Denman. Music Revised by Thomas Murby. London: Thomas Murby.

This little volume contains a collection of melodies with words for school and home use. For schools especially we think the work will be found useful.

REVIEWS POSTPONED.

"The Scientific Structure of the Universe." By James A. Moncreiff, C.E. (Marcus Ward and Co.)

"Murby's Imperial Copy-books." (Murby.)

Capsuling Bottles.—In France a new system of capsuling bottles has come into vogue which is more rapid than the use of metal capsules, and is thought, by some, to give a more elegant effect. The neck of the bottle is dipped into a viscous volatile liquid and immediately withdrawn with a rotary movement. This leaves a transparent capsule, the effect of which is improved by first attaching a monogram or trade mark to the top of the cork or upper end of the bottle neck. The following is the formula for the liquid:—Yellow resin, 20 parts; ether, 40; collodion, 60; fuchsine, or other tint, *q. s.*

Correspondence.

TURNBULL'S PATENT.

TO THE EDITOR OF THE SCIENTIFIC AND LITERARY REVIEW.

Dear Sir,—With your kind permission I wish to insert in your valuable journal a few remarks on the construction and mode of working single and compound engines (which was the subject of consideration at the recent meeting of the Inventors' Institute). Many ingenious arrangements have been tried to dispense with cranks, connecting rods, &c., by endeavours to obtain a rotary engine that could be worked with economy and diminished wear. Compared with reciprocating engines, great practical difficulties has prevented their success and adoption.

Reciprocating engines have been much simplified and made on almost every possible plan to diminish the working parts and obtain the most direct motion to the crank when compared with the old type of engines with beams, side levers, &c.; but there is need of a simpler engine, with more direct motion to the crank, to further economise and diminish friction in the working parts. The oscillating engine from its great cost, and the indirect manner of working the valves, causing extra parts, has prevented its general adoption; and the trunk engine, with its great frictional surface and loss of heat by irradiation from the trunks, has prevented it from superseding ordinary engines with connecting rods, motion bars, &c. Improvements recently patented by Mr. W. Turnbull, of which I give a brief description applicable to single and compound cylinder engines, and having fixed cylinders and working the steam valves direct from the eccentric or link motion, dispenses with connecting rods, motion bars, &c., and couples the piston and crank direct by the piston rod; the variable positions of the rod are met by a sliding stuffing-box moving steam tight on the cylinder cover. I likewise use an improved method of varying the expansion in single acting engines by working a small valve on the steam valve, the expansion being altered from the starting lever by the variable travel of the steam valve without additional hand gear, cutting the steam off at an earlier part of the stroke, and maintaining it longer on the piston than the ordinary valve and link motion. The advantage in compound cylinder engines consists in the increased power and economy obtained from the steam by each cylinder communicating with the condenser; the steam is transmitted from the pressure side of the small piston to the pressure side of the large piston by an intermediate valve in the large cylinder steam chest, working in unison with its steam valve; the remaining steam in the small cylinder passes through the intermediate valve to the condenser; steam is supplied to the small cylinder by a plate or block valve, the amount of steam being regulated by an ordinary link motion. With this plan of compound cylinder engine the cylinders can be made of equal diameters without loss of power or economy, which cannot be done in other compound engines without loss.

The exhaust steam in locomotive engines I condense by the continuous cooling of the injection water, forcing it into spray, and exposing it to a current of cold air passing through the condenser produced by the motion of the engine. Any vapour arising from the water is condensed by passing it over a series of metallic tubes, having a current of cold air passing through them by the motion of the engine. In tram-car and stationary engines the air is forced or drawn by a centrifugal fan. A portion of the condensing water is used to supply the boiler; or the steam is condensed over a series of metallic tubes having a current of cold air passing rapidly through them, and the water arising from the condensed steam conveyed to the boiler. These, Mr. Editor, are the advantages obtained by the improvements.
—Yours truly,

William Turnbull.

14, Pellant-road, April 28, 1880.

FLUID FOR PRESERVING ORGANIC SUBSTANCES.

M. Wickersheimer, of the University of Berlin, has invented a fluid for the preparation of animal and vegetable tissues, which surpasses anything before known in its power of preserving the colour, form, and elasticity of specimens treated with it.

The fluid may be injected into the veins of the body to be preserved by it, or the entire object may be immersed in it. In either case the elasticity of the tissues and the flexibility of the joints are preserved.

At a recent meeting of the Philadelphia Academy of Natural Sciences, Professor Barbeck described a number of skeletons, which showed beautifully the combined movements of the chest, larynx, and other parts engaged in the mechanism of breathing. Several skeletons of snakes, which had been treated with the fluid more than a year previously, permitted of undulatory and spiral movements. Lungs thus prepared may, even after years, be inflated by means of bellows. Such old lungs were seen to swell to ten times their size in the collapsed state, the lobes became distinct, the brown colour gradually changed into red, and the whole organ appeared as if taken from a fresh body. Sections of delicate tissues, morbid formations which have been removed by an operation, will appear after months as if in a fresh state, and may thus be preserved for future study.

All sorts of vegetable organisms may also be preserved in this fluid. A colony of exquisite fresh water algæ, which had been in the fluid for a year, appeared to be growing in the water.

The Prussian Government has purchased this valuable discovery, and the Minister of Instruction has published it in his official organ for the benefit of the scientific world. The formula for the preparation of the fluid is as follows:—In 3,000 grammes of boiling water dissolve alum, 100 grammes; common salt, 25 grammes; saltpetre, 12 grammes; carbonate of potash, 60 grammes; arsenious acid, 10 grammes. After cooling and filtering, add to every ten litres of the solution four litres of glycerine and one litre of methylic alcohol.

The method of application differs according to the nature of the objects to be preserved. Anatomical preparations that are to be preserved dry are immersed in the fluid from six to twelve days, according to their size, then taken out and dried in the open air. Hollow organs, such as the lungs, &c., must be filled with the preserving fluid, then laid in a vessel containing the same liquid, and afterward distended with air and dried. Smaller animals, such as crabs, beetles, lizards, frogs, &c., if the natural colours are to be preserved unchanged, are not to be dried, but put immediately into the preparation. The same fluid may be used for the purpose of preserving human bodies during transportation, or even for more permanent embalming.

HOW COPYRIGHT DIFFERS FROM PATENT RIGHT.

The Supreme Court of the United States has lately given two opinions which illustrate what mistaken notions of copyright are sometimes held by courts, as well as by lawyers and clients. Some years ago Charles Selden, of Cincinnati, published a book entitled "Selden's Condensed Ledger, or Book-keeping Simplified." In this book, and in one or two others that he about the same time, the author explained a new system of book-keeping which he had invented, and gave such directions, specimen pages, headings, &c., as would enable a person to understand and apply the system. Each of these books was duly copyrighted. Selden claimed that his copyright secured to him a monopoly of the system which he had invented, and demanded a royalty for the privilege of using it. The system appears to have been a desirable one, and the royalty was paid by a goodly number of persons, including not a few county auditors. But others made use of it without asking the inventor's permission or paying any royalty, and one person published a book embodying substantially the same method. Litigation resulted, and the question was raised whether Selden's plan or system of book-keeping was protected by the copyright of his books. The Circuit Court of the United States decided that it was. This judgment is now reversed by the Supreme Court, which does not deny that a work on book-keeping may be the subject of a copyright which will prevent the unauthorised copying of the book. But the system or secret of book-keeping described in the book is not a subject of copyright. This is an invention for which protection, if any there be, should be sought under the patent laws. The court drew a distinction between a book as a composition and the art, process, or secret described in it. "A treatise on the composition and use of medicines," says the opinion, "be they old or new, on the construction and use of plows, or watches, or churns, or on the mixture and application of colours for painting or dyeing, or on the mode of drawing lines to produce the effect of perspective, would be the subject of copyright; but no one would contend that the copyright of the treatise would give the exclusive right to the art or manufacture described therein."

In the other case referred to copyright was claimed in a map of New York city constructed on an original and peculiar plan. Substantially the same plan was used without authority in a map of Philadelphia. The United States Supreme Court without denying that the unauthorised publication of the map of New York would be piratical, held that the copyright did not protect the mere plan, and hence did not prevent the defendant from making a map of another city on the same plan.—*N. Y. Times.*

THE EFFECT OF LIGHT UPON SOME REAGENTS AND CHEMICAL COMPOUNDS.

By T. P. BLUNT, M.A. Oxon, F.C.S.

(Read before the Society of Public Analysts on March 17, 1880, and reported in the *Analyst* for April.)

THE following remarks are for the most part of a practical character, and intended to point out the importance to the chemist of a consideration of the effects of exposure to light upon some of the ordinary reagents of the laboratory, which have not been usually regarded as subject to its influence. My attention was first drawn in this direction in the course of an investigation into the action of light on certain organisms, upon which Dr. A. H. Downes and I have been engaged for more than two years. Nearly all our results have been embodied in a series of papers read before the Royal Society, but it may not be considered impertinent to reproduce here such of them as have a bearing upon the practical question of the preservation of reagents. I do not pretend that all the facts detailed below are new, but some of them have certainly not received the attention they deserve. Oxalic acid forms a most useful basis for a standard solution, owing to the ease with which it is obtained in a pure state by crystallisation, and subsequently weighed, but it has fallen into disrepute on account of the instability of the normal solutions prepared with it; now it has been clearly proved by us that this instability is solely due to the action of light, and that normal volumetric oxalic solution (6·3 per cent.) may be preserved unchanged for any period in the dark. The same remark applies even to the decinormal (0·63 per cent.) solution, if the precaution be taken of first boiling to destroy germs or organisms, otherwise it may become turbid and lose strength in the dark. In the light decinormal oxalic solution is rapidly destroyed by oxidation. In one of our experiments made in test tubes, partially filled, and plugged with cotton wool, six months' insolation, between January 21st and June 15th, sufficed to destroy both acid taste and reaction, apparently leaving nothing behind but pure water—the carbonic acid formed having of course escaped. I have already, in the columns of the *Analyst*, called attention to the fact that a weak permanganate solution, such as that used by Tidy in water analysis, is perfectly permanent for one month when kept in the dark. My experience extends now over a longer period, and I find that such a solution may be preserved unchanged in the dark for many months in spite of variations of temperature. Potassium iodide and ferrous iodide are a pair of compounds whose conduct under light is mutually anomalous; solid potassium iodide in presence of light and moisture soon becomes tinged with yellow through the liberation of iodine, while it is a fact well known to pharmacists that in order to preserve the syrup of iodide of iron (ferrous iodide) from discolouration it should be placed in white glass bottles in the strongest available light. We once half filled a test tube with the syrup and exposed it in a window in the summer. Each morning a brown layer appeared on its surface, the accumulation of the past night. This gradually disappeared in the sunlight, so that before evening the contents of the tube had once more become completely colourless, and this phenomenon occurred as long as the experiment was under observation. It was satisfactorily proved that the only effect of the sugar was to render the solution more stable, for aqueous solutions of ferrous iodide were found to become discoloured much more rapidly in the dark than when exposed to sunlight. Solutions of potassium iodide behave in an exactly opposite manner to those of ferrous iodide in all the respects mentioned above; they become discoloured under sunlight, but can be preserved indefinitely in the dark, and if a dilute solution which has turned yellow in the light be afterwards screened from it, the colour very gradually disappears.

The cause of the discolouration of potassium iodide by light having been much discussed of late years, it may perhaps be worth while to give a somewhat detailed account of our own attempts at the solution of the problem. Four tubes containing a weak solution of the salt, which filled them to about one-third of their capacity, were exhausted at the Sprengel pump; air which had been freed from carbonic and all other acids by long contact and frequent agitation with caustic potash was then admitted by a special arrangement, and the tubes were sealed off; two were insolated and two encased. At the same time some more of the solution was placed in four ordinary test tubes, which were simply plugged with cotton wool, and exposed to sunlight and darkened respectively in a similar manner to the previous pairs. All the insolated tubes rapidly became coloured, no difference being noticeable between the rates of colouration in the tubes containing ordinary and purified air, those kept in the dark being perfectly preserved. A pair of tubes was now charged with solution, exhausted, and sealed off. No change took place on insolation, and thus the somewhat improbable alternative of mere dissociation was disposed of, and the conclusion remained that the effect of light was due to direct oxidation without the intervention of any acid.

There can be little doubt that solution of potassium iodide of any strength could be perfectly preserved in a well-stoppered bottle in the dark, and would be much more convenient than the fragments of solid salt we are most of us in the habit of using. A similar reaction to that observed in the case of potassium iodide under light occurs with dilute solutions of all the alkaline oxalates, which are gradually oxidised with the formation of carbonates, but much less rapidly than a solution of oxalic acid of corresponding strength. In operating on solutions containing the same proportion of acid radical it was found that the decomposition was nearly equal in the case of the oxalates of sodium, potassium, and lithium, but somewhat greater in that of the ammonium salt; hence it would appear to be desirable to keep solutions of ammonium oxalate in the dark when they are required to be preserved of uniform strength, as for instance where they are employed in the volumetric estimation of lime.

In the course of one of our experiments two tubes were partially filled over mercury with a mixture of atmospheric air and ammoniacal gas, one was then exposed to light and the other darkened. On examining the tubes after many months the mercury had risen in the encased tube. The surface of the metal was blackened and its convexity lost, these appearances being evidently due to oxidation. In the tube in the light, on the other hand, the level of the mercury remained unchanged, and its surface was clean, bright, and convex.

These results afford strong presumptive evidence against the formation of ozone in sunlight, and consequently against the views of those writers who have ascribed some of the phenomena of oxidation under light to its intervention, for it is well known that a trace of ozone in air is capable of destroying the convexity and lustre of the mercurial surface.

Dr. Dupré said he heard a similar paper read some time ago, and he went the next day and examined his decinormal oxalic acid which had been made about 14 months, and standing in a place never struck by sunlight. He had some of the exact acid with which it was made, and could certainly find no difference between the two.

Dr. Muter said that had it been in the light it might have been affected. He thought it was probably through germs if any change took place. If no germs could get in it a solution might remain correct for a number of years.

Mr. Hehner pointed out that some germs were not fond of light as they flourished much better in the dark. If fungus were exposed to the sunlight it would very quickly die.

Dr. Bartlett said that he had some potassium iodide which had been for about 20 years in the dark in his laboratory, and it had become of a deep yellow colour.

ELECTROTYPING WITH IRON.--Herr Böttger describes a process for steeling copper plates by electrolysis. 100 parts of ferrous-ammonia sulphate, together with 50 parts of sal-ammoniac, are dissolved in 500 parts of pure water, a few drops of sulphuric acid being added to acidulate the solution. The copper plate is connected to the negative pole of a battery of two or three Bunsen elements, an iron plate of equal size being employed as an anode. The solution is maintained at from 60 deg. to 80 deg. The deposit of iron is of a hard, steel-like quality, and is very rapidly formed.

SANITARY ENGINEERING.

At the meeting of the Institution of Civil Engineers, on Tuesday, the 13th of April, Mr. W. H. Barlow, F.R.S., President, in the Chair, the first Paper read was on the "Abingdon Sewerage," by Mr. Charles Foote Gower, M. Inst. C.E.

Being under notice to desist from any longer discharging the sewage of their town into the River Thames, the authorities of Abingdon called upon Mr. Bailey Denton, M. Inst. C.E., in the year 1874, to advise them as to the best means of dealing with the sewage, so as to satisfy the requirements of the Thames Conservators. Mr. Denton having, with the assistance of the Author, made an inspection of the town and neighbourhood, recommended that 20 acres of land should be acquired, for the purpose of cleansing the sewage by intermittent filtration, and gave at the same time a general description of the necessary sewers, pumping-station, and other works since carried out.

The population of Abingdon was about 6,000; but provision had been made, in the construction of the works, for at least 10,000 persons. The normal flow of sewage, when undiluted, was taken at 250,000 gallons per day. The ordinary level of the Thames at Abingdon was 162 feet above Ordnance datum. In flood time it reached nearly 167 feet. The River Ock was kept up for the purpose of working mills at a level of 168 feet. The surface levels in the streets of the town varied from about 170 to 200 feet above Ordnance datum. The subsoil water in that part of the town contiguous to the Thames accorded pretty nearly with the river level, 162 feet; but in other parts of the town, previous to the carrying out of the sewerage works, it was regulated by the level of the Ock Mill Stream, and the consequence was that it sometimes rose, in wet seasons, almost to the level of the streets, and proved injurious to the health of the inhabitants. The sewers in Abingdon were formerly very inadequate for the duty required of them; they had been retained, however, in connection with the street gullies, to carry off rain water from the streets. The level of the land selected for the purification and utilization of the sewage varied from 165 to 168 feet above Ordnance datum. From the general surface height and contour of the town, it was impracticable to bring the sewage on to this land without lifting it from 10 to 20 feet from the invert of the outfall sewer. In the design for the new sewers no rain water was to be admitted except from back-yards, roofs, and other surfaces, from which it could not economically be kept out. Having regard to the purification of the sewage, and the necessity for pumping, every precaution was therefore taken to keep the quantity to be dealt with within definite limits. The level of the subsoil water in Ock Street and other places had been reduced by laying separate drains, open jointed, beneath or contiguous to the sewers.

In laying the sewers the joints were caulked with tarred gasket and cement, and in some cases were bedded and surrounded with concrete, or clay puddle, to prevent the ingress of subsoil water or the escape of the sewage into the surrounding soil. Meanwhile, the town having been without a public water supply, arrangements were made for flushing the sewers by inlets from the river and from other sources. The main outfall sewer from the town was 18 inches in diameter, and was capable of discharging 2,000,000 gallons in twenty-four hours, being eight times the estimated dry-weather flow of sewage. The secondary sewers in the town consisted of 15-inch, 12-inch, and 9-inch pipes. The lower portion of the outfall sewer was 3 feet 6 inches in diameter, and served as a reservoir to hold the night flow of sewage, in connection with the pumping station. This sewer was at times subject to considerable internal pressure from the sewage collected in it, as well as to external pressure from the subsoil water outside being 8 feet below the ordinary level of the Thames. Each engine could pump 400 gallons of sewage per minute; thus both engines working together would lift above 1,000,000 gallons per day. In connection with the engines, a storm overflow from the pumping reservoir had been provided, to relieve the latter in case of heavy storms, floods, or accidents to the engines; upwards of 100,000 gallons must flow into the reservoir before any overflow could take place. This provision was more than enough for the night-flow of sewage, if the reservoir was pumped empty at the close of the day. The cost of the sewerage of the town had been £8,750, including a portion of the charge for private connecting sewers, which were executed by the contractor for the main sewers up to the boundaries of private properties on each side of the street. The cost of the engines and pumping station, including fencing of yard, weighing machine, and sewage screens, had been £2,500, of which sum the engines cost about £800. The annual cost of pumping for the last two years had not exceeded £150; but with an increase of water supply it would probably be somewhat greater. The area of land acquired by the Corporation of Abingdon was more than double what Mr. Denton at first proposed. The farm, with cottage and buildings, was let at an annual rental of £4 10s. per acre, the Corporation pumping the sewage. The works were practically completed in 1877, and from that time, with but little exception, the Thames had been free from Abingdon sewage; the land first received it, and after passing through the soil, the effluent water flowed into the river. Samples of the effluent were found by analysis to be better in quality than the water of many of the wells in use in the town. The sewers were freely ventilated throughout the town by shafts, which were also used for inspection and for flushing. The latter operation had to be put into force at least twice a week, owing to the comparatively sluggish flow, the amount of water used for domestic purposes being very small.

The second paper read was on "The Main Drainage of Torquay," by Mr. George Chatterton, M.A., Assoc. M. Inst. C.E.

The Author stated that Torquay, on the northern shore of Torbay, had a population of about 30,000. Previous to 1878 the sewage was discharged into the bay by three outfalls, and was a nuisance at low water and in hot weather. The main sewers were constantly closed at their outlets by the sea, which at high water flowed up a considerable way into the town; many of them were of insufficient capacity, and the ventilation being defective, foul gases were driven into the houses. The scheme described was designed and carried out by Sir J. W. Bazalgette, C.B., V.P. Inst. C.E. Its main features were a high and a low-level system of sewers. The high-level sewer commenced near Tor Abbey, and had an outfall at Hope's Nose, the eastern extremity of Torbay. The set of the tide at the point of outfall was from the bay at all times, and at present no sewage could enter the bay. The total length of the high-level sewer was 17,030 feet, and it was 7 feet in diameter for a length of 11,387 feet; the fall was 1 in 1,177; the level of the invert at the outfall was 4·16 feet below high water of spring tides. The quantity of water brought into the town daily was 600,000 gallons; the dry weather flow of the sewers was about 1,250,000 gallons, the difference being caused by the streams, springs, and overflow of wells, which had been taken into the sewers. In constructing the high-level sewer, it was necessary to drive three tunnels—at Waldon Hill, Meadfoot Hill, and Kilmorie Hill respectively. The Waldon Hill tunnel was in Devonian limestone; it was 1,150 feet long, the size being 5 feet 6 inches by 4 feet; it was driven from two open faces, the average progress was 9·12 lineal feet per week from each face; hand labour alone was employed, and the invert portion was lined with Portland cement concrete. The cost of the sewer completed was £1 16s. per lineal foot. The Meadfoot tunnel was 4,458 feet long; the sewer was 7 feet in diameter. This tunnel was in limestone rock for the greater part of its length, but some of it was in soft ground. Hand labour alone was employed, it was driven from four working shafts; the average progress per week from each face was about 15 feet. Where the ground was limestone it was lined with Portland cement concrete 9 inches thick, while the sewer in soft ground was formed of brickwork. The average cost per lineal foot for driving this tunnel was £1 9s., and the total cost of completed sewer £2 10s. per lineal foot.

A new roadway and sea-wall were constructed along the Meadfoot beach, with the sewer under the road. The sewer consisted of a single ring of brickwork, surrounded with, and founded upon, lias lime concrete carried down to the solid rock. The sea-wall was 1,900 feet long, and was built of random-coursed limestone masonry, backed with rubble. The Kilmorie Hill tunnel was 4,564 feet long. The nature of the rock varied greatly; in some places it was an argillaceous siliceous grit, with bands of pure quartz, and extremely hard; in other places it was of a shaly composition, while near the outfall it was limestone. The advance per week by hand labour was so slow, that it was found necessary to introduce rock-boring machinery at the open face and at one shaft. The progress in feet per week was increased by using rock-boring machinery at the open face in the ratio of 2·33 to 1, and at the shaft in the ratio of 2·19 to 1. The cost per lineal foot was also increased, but not in a corresponding ratio. Ingersoll rock-drills were used, and the air was compressed by Sturgeon's high-speed air compressors. Dynamite was found to be the most effective and economical explosive; 11 tons of it were used without a single accident. There were thirteen ventilating shafts on the high-level sewer. The flow of sewage was continuous, so that sewer gas was not generated to anything like the same extent as in tank sewers. There had been no deposit in the sewer. The low-level system received the sewage of about one-tenth of the population of Torquay; the total length was 5,184 feet. Surface water was kept out of this system as far as possible. The low-level sewage was lifted about 15 feet by a water-pressure engine, with pumps in duplicate. The pumps were worked by a head of 250 feet of water from the town main, and required no superintendence.

A contract for the construction of the works was entered into in 1875, but in January, 1876, the contractors suspended operations, having executed work to the value of about £8000. On receiving fresh tenders the Local Board became alarmed; the lowest tender was £75,000, and this did not include the cost of extra work and other items, which would have involved a total outlay of £103,327, while the engineer's estimate for the same amounted to only £65,000. Under these circumstances the Local Board, acting under the advice of Sir J. W. Bazalgette, determined not to accept any tender, but to execute the works themselves by administration. Mr. G. Phillips was appointed resident engineer, and the whole scheme was completed by August, 1878, or in two years and five months from the commencement of operations by the Local Board. The total cost of the scheme to the Local Board was £66,145, a saving to the town of £37,182 by not accepting the lowest tender. The cost of the Kilmorie tunnel was £14,358, or £3 2s. 11d. per lineal foot. Of this amount, the cost of the driving was 74·53 per cent., of the trimming 15·98 per cent., and of the lining 9·49 per cent. The rock-boring machinery cost £1,395. The execution of the works had involved a rate of about sevenpence in the pound on the present rateable value.

EFFECT OF INTENSE COLD ON BEER.

THERE are some advantages and many disadvantages to the brewer arising from very cold weather. Beer keeps far better when the thermometer stands below 50° F., but when the thermometer is for days several degrees lower than the freezing point the usual arrangements for storing beer in this country altogether fail to keep it in good condition. The ordinary cellars, both of breweries, retail establishments, and private houses, are but ill adapted to protecting beer from intense cold, and the result has been apparent during the winter in large quantities of beer either turning up cloudy or failing to drop bright: with a reduction of temperature there is a diminished power of holding albuminous bodies in solution, and therefore some of these separate, producing a cloudiness which requires a long period of high temperature to remove again. Another result of cold weather is to cause beer to turn flat; in its normal and healthy state beer should undergo a slow but regularly secondary fermentation, by which a certain amount of carbonic acid gas is evolved which serves to keep up the "life" of the beer; at very low temperatures the organisms which cause this fermentation are inactive, and no gas being evolved the beer becomes flat. The greatest danger to beer during the winter months is the sudden changes of temperature; with the thermometer one day at 55° F. and the next at 25° F. it is impossible to keep beer in condition, at least with the usual cellar arrangements which prevail in this country.

SCIENTIFIC SOCIETIES IN THE UNITED STATES.

AT recent meetings of scientific and professional societies in this city, the *Scientific American* states that officers for the ensuing year have been elected as follows:—

New York Academy of Sciences.—President, John S. Newberry; first vice-president, Thomas Eggleston; second vice-president, B. N. Martin; corresponding secretary, A. R. Leeds; recording secretary, O. P. Hubbard; treasurer, J. H. Hinton; council, D. S. Martin, G. N. Lawrence, A. A. Julien, A. C. Post, W. P. Trowbridge, Louis Elsberg; curators, B. G. Amend, C. F. Cox, B. B. Chamberlin, Charles A. Seeley, W. H. Leggett; finance committee, T. B. Coddington, Philip Schuyler, Thomas Bland.

American Ethnological Society.—President, Alexander J. Cotheal; vice-presidents, Charles E. West, LL.D., and Charles C. Jones, jun.; corresponding secretary, Chas. Rau; recording secretary, T. Stafford Drowne, D.D.; treasurer, Alexander J. Cotheal; librarian, Henry T. Drowne; and executive committee, George H. Moore, LL.D., Asa Bird Gardner, LL.D., and Henry T. Drowne.

American Institute of Mining Engineers. —President, Wm. P. Shinn, of St. Louis, Mo.; vice-presidents (in place of those whose term expires this month), James A. Burden, of New York; Dr. Charles B. Dudley, of Altoona, Penn.; and Persifer Frazer, jun., of Philadelphia. Managers (in place of those retiring this month), James C. Bayles, of New York; W. S. Keyes, of San Francisco; and Percival Roberts, jun., of Philadelphia. Treasurer, Theodore D. Rand, of Philadelphia. Secretary, Dr. Thomas M. Drown, of Easton, Pa.

RECENT AMERICAN AND FOREIGN PATENTS.

MR. John Hill, of Columbus, Ga., has patented an improved feed indicator for cotton openers. This relates to a convenient and certain means for determining the quantity of cotton to be fed to cotton openers, which serve to tear up and loosen the tussocks of cotton as they come from the bale, and distribute the fibre in the form of a fleece. In using these openers two are sometimes employed together to act successively upon the cotton, or one opener may be employed in connection with a lapping machine, the function of which latter is to press together and compact into a fleece. In either case a hollow trunk has been employed as a conduit, in connection with a blast of air passing through the same to act as a vehicle to carry the fleece from one opener to the other, or from the opener to the lapping machine, which second machine is generally located upon a different floor, or at a point more or less remote from the first. The invention consists in making the boxes of the upper feed roll of the second opener or lapper vertically adjustable, and connecting them with an index hand within sight of the operator at the first machine, so that the operator, at a point remote from the second machine, can tell the amount of cotton fed to the second machine by the rise or fall of the movable roller due to the passage of a greater or less quantity of cotton to the second machine.

An improved stock car has been patented by Mr. Sanford Bray, of Charlestown, Mass. The object of this invention is to furnish cattle cars so constructed that the cattle will be arranged compactly, and can be conveniently loaded and unloaded.

Mr. Eli Shafer, of Sigourney, Iowa, has patented an improved car coupling, consisting of an open-mouthed drawhead, within which is a flat-headed drawbar encircled by a strong spiral spring to force it outward. In the face of the head of the drawbar there is a transverse rectangular groove, within which the flattened end of the link is placed and held by a metallic block. The coupling has other novel features which cannot be explained without engravings.

Mr. James E. Purdy, of Tallahassee, Fla., has patented a means for connecting cars, which is so constructed that the cars will couple themselves when run together, and will not be liable to become accidentally uncoupled.

Mr. Ole C. Nuubson, of Mount Horeb, Wis., has patented an improved milk cooler, which consists in a milk cooler with trough, gauges, and faucets, and divided into separate chambers by a diaphragm whose central tube extends through the cover.

Mr. Chas. V. Richards, of Skowhegan, Me., has invented an improved clasp, which consists in a case having its edges so arranged as to form jaws, between which a flanged finger piece is pivoted. A wire loop or tongue is adapted to pass through a slot in the case, and has its ends passed through the flanges of the finger piece.

An improved buckle shield, patented by Mr. David Mosman, of New Britain, Conn., consists of a metal plate with curved ends provided with transverse slots and arranged over the buckle, the object being to ornament the harness and to prevent the horse's tail and mane from catching in the buckle.

An improved lubricator, patented by Mr. Oscar A. Rollins, of Campello, Mass., relates to the class of oil pumps designed for supplying oil for lubricating purposes to steam engine cylinders. It consists of an oil forcing piston driven with an intermittent motion by connection with some of the moving parts of the engine.

Mr. John F. Curtice, of Fort Wayne, Ind., has patented an improved device for heating sad irons upon the top of a stove. The invention consists in an improved sad iron heater formed of an open bottomed box divided into compartments by vertical partitions, having the middle part of its top stationary and provided with a handle, and the side parts of its top inclined and formed of doors shutting air tight, or nearly so, and provided with spring catches, to adapt the device for use in heating sad irons upon the top of an ordinary stove.

Mr. Henry S. Kratz, of Chicago, Ill., has patented an improved shelf for attachment to stove-pipes for the purpose of supporting culinary vessels, dishes, cloths, or other things requiring to be kept warm or dried.

An improved road-scraper, patented by Mr. Samuel H. Dudley, of Bantam Falls, Conn., consists in the combination of guard bars having their upper ends bent forward at right angles to fit into the notches in the upper edge of the plank, and having sockets formed in their lower parts to receive the rear ends of the draw rods, with the plank, the draw rods, and the staples of a scraper.

Mr. Charles A. Gale, of Piqua, Ohio, has patented an improved apparatus for taking solar prints from negatives. The invention consists in the combination of the two frames, hinged to each other at one edge, and provided at the other edge with a bolt and hand nut or equivalent clamp.

Mr. Antoine B. Dembrun, of New Orleans, La., has invented an improved furnace for cooking and baking, and various other uses. It consists in the combination of a furnace, an iron basket, and a hinged grate to form a compact, convenient, and portable furnace.

Messrs. Cornelius Bennett and Parker Burnham, of Silver City, Territory of New Mexico, have patented an improved apparatus for separating gold and other metals from dirt and sediment by what is known as the "dry" process. The invention consists in a combination of devices which cannot be explained without engravings.

Mr. Solomon B. Ellithorp, of Rochester, N.Y., has invented an improvement in waxing mechanisms for sewing machines. It consists of two arms carrying sponges, which are moved reciprocally by the operating mechanism of the machine in such a manner that they pass over melted wax held in a suitable receptacle, taking up a suitable quantity thereof, and at the proper time are rubbed and clasped against the two threads carried by the needle and shuttle.

An improved cord adjuster has been patented by Mr. William W. Batchelder, of New York city. The object of this invention is to furnish cord adjusters and holders so constructed that cords may be moved longitudinally through them as required, and may be held securely in place when adjusted. It consists in a cord adjuster and holder formed of a tube having longitudinal flanges or ribs upon its inner surface, an interior swivelled spiral and a swivelled collar, so constructed and arranged that the cord may be moved longitudinally by turning the collar.

Mr. Alfred E. Feroe, of Tivoli, N.Y., has patented an improved process of obtaining wort, which consists in first dissolving the diastase of the ground malt in warm water at less than a converting temperature, and then bringing the mash to and keeping it at a converting heat by continuously drawing the wort from the bottom of the tub, heating, and passing through the mash, as specified.

Mr. Henry S. Kratz, of Chicago, Ill., has patented an improved shelf for attachment to stovepipes for the purpose of supporting culinary vessels, dishes, clothes, or other things requiring to be kept warm or dried.

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Past Presidents:

SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868. LORD RICHARD GROSVENOR, M.P.

President, SIR ANTONIO BRADY.

THE SESSION 1879—1880

Members' Meetings will be held at 8.15 p.m. on Thursdays, May 6th and June 3rd.

On 6th May, Exposition of Inventions, and Patent Law Questions.

Executive Council Meetings at 7.30, on same evenings as above.

Annual General Meeting, Thursday, May 20th, at 4.30 p.m.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.

F. W. CAMPIN, Sec.

Proceedings of the Institute.

MEMBERS' MEETINGS.

On the 22nd April Mr. T. Morgan gave an address on some recent inventions of considerable importance, amongst which that of Mr. Turnbull for "Improvements in Compound Engines," &c., engaged nearly the whole attention of the meeting. Mr. Turnbull was present at the meeting, and gave elaborate explanations of all its details. The discussion, in which Mr. F. H. VARLEY, Mr. GREENFIELD, and Mr. CAMPIN took part, was of a general character, in the course of which much approbation of his invention was expressed. A full description of this invention will be found in another column, as also a letter containing further explanation of same.

EXECUTIVE COUNCILS.

On the 8th April no business was transacted requiring to be reported to the members in general.

On the 22nd April the business was financial and routine.

Monthly Notices.

Artificial Felspars was the subject of a memoir by MM. Fouqué and Lévy communicated to the French Academy of Sciences on the 15th of March. The artificial formation of felspars, with base of baryta, strontia, and lead, by the production of crystallisation at a very high temperature, but below the point of fusion, being treated of. The production of minerals corresponding to oligoclaze, labradorite, and anorthite at elevated temperatures is especially interesting just now.

Dr. C. W. Siemens "On the Influence of Electric Light on Vegetation," was the subject of a recent paper at the Royal Society, which strikingly confirms his former statement on the same subject. He exhibited two pots of strawberries which had been grown in the usual way until the fruit buds appeared, when one of the pots was exposed to continuous light—that is, daylight through the day and electric light during the night, the other being left to the influence of ordinary daylight. The contrast between the two pots as exhibited at the meeting was remarkable: one bore a cluster of large, red, fragrant strawberries, the other a bunch still green, with the exception of one slightly red spot. The ripe fruit was the result of the combined light, from which the conclusion is drawn that electric light may be found useful in the ripening of fruit generally. The ripe strawberries were tasted by the President, and pronounced very good.

The London School of Medicine for Women closed its sixth winter session on the 25th ult. Instruction was given in anatomy, practical anatomy, chemistry, physiology, and practice of medicine. Forty ladies availed themselves of these opportunities, of whom twenty were also students at the Royal Free Hospital. A new feature in the arrangements is the establishment of tutorial classes in biology and experimental physics for students preparing for the preliminary scientific examination (M.B.) and first B.Sc examination. During May Dr. Sophia Jex Blake and Dr. Edith Pechey will give a course of lectures to ladies on hygiene.

A New Microphonic Apparatus, which receives words at a distance, is described by MM. P. Bert and d'Arsonville in the *Comptes Rendus* of the Académie des Sciences. The objects of their researches have been twofold: first, to strengthen the sound vibrations of speech, and, secondly, to collect these vibrations at the distance of several metres from the speaker.

A New Form of Lamp for the Electric Light has recently been invented by Mr. Charles Stewart, M.A. It consists of a number of square carbon rods placed radially upon a disc of wood or metal in such a manner that the inner ends of the carbon rods form a complete circle. There is a circular opening in the wooden disc through which the electric light is seen from underneath. The carbons, which are all forced towards the centre by a uniform pressure, move forward as they are consumed, and together form the positive electrode of the lamp. The negative electrode consists of a covered hemispherical cup of copper, which, before the current enters the lamp, rests upon the ring formed by the carbons. On the current entering the lamp an electro-magnet raises the metal electrode, and the electric arc is then formed between the circle of carbons and the metal electrode. There is a flow of water through the latter to keep it cool. The advantages which this lamp possesses are—1. It is automatic in its action. 2. It is capable of burning for a very considerable period. 3. It does not throw any shadows. 4. It is of simple and comparatively inexpensive construction. 5. The intensity of the light may be increased if so desired. This is the second lamp for the electric light which Mr. Stewart has recently invented.

Underground Currents of Electricity.—Two Americans, Messrs. Prescott, profess to have discovered that underground currents of electricity, flowing in all directions, form the true "earths" of lightning discharges. They assert that all houses, trees, &c., struck by lightning are underflowed by these currents, and that no houses, &c., standing on spots where there are no currents are ever struck. In protecting a house from lightning stroke, therefore, their method is to test the ground underneath, and if there are no earth-currents below to take no further trouble; but if these currents are present, to earth the rod, which they erect in the parts of the ground below where they are strongest.

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THE HORTICULTURAL VALUE OF THE ELECTRIC LIGHT.

Arctic explorers have frequently remarked that vegetable productions which in temperate climates require a long time to grow to any perfection mature in a few weeks under the continuous sunshine of the Arctic summer. A similar rapidity of growth is shown by annuals in subarctic latitudes; for instance, in Northern Norway the summer sun, though never reaching a high altitude, yet remains above the horizon from sixteen to twenty hours per day.

A species of corn which flourishes in Canada is said to have failed to ripen in Kentucky, though the warm season there is some weeks longer than in Canada. The superior rapidity with which vegetation pushes forward during periods of full moon and light nights has also been widely noticed; these facts of general observation, with others of a more experimental character, going to show that many of the plants of our temperate climate thrive in proportion to the duration of the daily (direct or indirect) sunshine they enjoy, rather than according to the temperature of the air.

A curious confirmation and extension of these observations in regard to the influence of light upon vegetation is furnished by the recent experiments of Dr. C. W. Siemens, testing the influence of the electric light upon certain plants. These experiments were described by Dr. Siemens at consideraale length at a late meeting of the Royal Society. According to the report in the *Times* the method pursued by Dr. Siemens was to plant quick-growing seeds and plants, such as mustard, carrots, ruta-bagas, beans, cucumbers, and melons, in pots, dividing the pots into four groups, one of which was kept entirely in the dark, one was exposed to the influence of the electric light only, one to the influence of daylight only, and one to daylight and electric light in succession. The electric light was applied for six hours each evening—from 5 to 11—and the plants were then left in darkness during the remainder of the night. The general result was that the plants kept entirely in the dark soon died; those exposed to the electric light only or to daylight only throve about equally; and those exposed to both day and electric light throve far better than either, the specimens of mustard and of carrots exhibited to the society showing this difference in a very remarkable way. Dr. Siemens considers himself as yet only on the threshold of the investigation, but thinks the experiments already made are sufficient to justify the following conclusions:—

1. That electric light is efficacious in producing chlorophyl in the leaves of plants, and in promoting growth.

2. That an electric centre of light equal to 1,400 candles placed at a distance of two metres from growing plants appeared to be equal in effect to average daylight at this season of the year; but that more economical effects can be obtained by more powerful light centres.

3. That the carbonic acid and nitrogenous compounds generated in diminutive quantities in the electric arc produce no sensible deleterious effects upon plants enclosed in the same space.

4. That plants do not appear to require a period of rest during the twenty-four hours of the day, but make increased and vigorous progress if subjected during daytime to sunlight and during the night to electric light.

5. That the radiation of heat from powerful electric arcs can be made available to counteract the effect of night frost, and is likely to promote the setting and ripening of fruit in the open air.

6. That while under the influence of electric light plants can sustain increased stove heat without collapsing, a circumstance favourable to forcing by electric light.

7. That the expense of electro-horticulture depends mainly upon the cost of mechanical energy, and is very moderate where natural sources of such energy, such as waterfalls, can be made available.

In the discussion which followed the reading of the paper it was pointed out that the evidence seemed to show the practical identity of solar and electric light with respect to their action on vegetation; and it was suggested that the method of subjecting plants to electric light might afford great facilities for the scientific investigation of the influence exerted by light, as compared with other agencies, in promoting the formation of the active principles or most valuable constituents of plants, such as the quinine of the cinchona bark, the gluten of wheat, &c. Before concluding his observations, Dr. Siemens placed a pot of budding tulips in the full brightness of an electric lamp in the meeting room, and in about forty minutes the buds had expanded into full bloom.

If, as we are inclined to believe, the electric light is an artificial sunshine we are by no means surprised to find the results of Dr. Siemens's experiments have been such as they have, but nothing could well be more conclusive as showing the importance of the electric light than the facts established by the researches of Dr. Siemens.

Owing to the fact that the production of the electric light is at present so difficult and expensive that its use is looked upon rather as a matter of luxury than of ordinary requirement, one cannot regard these experiments of Dr. Siemens's as practical utilities, but for all that a wide field of progress is opened up by them, and we shall be much surprised if at no distant period these researches do not become the foundation of practical improvements in horticulture of first rate importance.

Proceedings of Societies.

ROYAL SOCIETY.

FEB. 26TH.—The President in the chair.—The following papers were read: "On the Solubility of Solids in Gases," by Messrs. J. B. Hannay and J. Hogarth; and "On the Artificial Formation of the Diamond: Preliminary Notice," by Mr. J. B. Hannay.

MARCH 4TH.—The President in the chair.—The list of names of the candidates for election into the society was read. The following papers were read: "Fired Gunpowder: Note on the Existence of Potassium Hyposulphite in the Solid Residue of Fired Gunpowder," by Capt. Noble and Mr. F. A. Abel; "On the Dynamo-Electric Current, and on certain Means to Improve its Steadiness," and "On the Influence of Electric Light upon Vegetation, and on certain Physical Principles Involved," by Mr. C. W. Siemens.

MARCH 18TH.—The President in the chair.—The following papers were read: "On the Structure of the Immature Ovarian Ovum in the Common Fowl and in the Rabbit, with Observations on the Mode of Formation of the *discus proligerus* in the Rabbit, and of the Ovarial Glands or 'Egg Tubes' in the Dog," by Prof. Schäfer; "Researches into the Colouring Matters of Human Urine, with an Account of the Separation of Urobilin," by Dr. M'Munn; "On the Analytical Expressions which give the History of a Fluid Planet of small Viscosity, attended by a single Satellite," by Mr. G. H. Darwin;" "On the Modifications of the Spectrum of Potassium which are effected by the Presence of Phosphoric Acid, and on the Inorganic Bases and Salts which are found in Combination with Educts of the Brain," by Dr. Thudichum; "On Magnetic Circuits in Dynamo and Magneto-Electric Machines," No. II., by Lord Elphinstone and Mr. C. W. Vincent; "On the Coalescence of Amœboid Cells into Plasmodia, and on the so-called Coagulation of Invertebrate Fluids," by Mr. P. Geddes; and "Some further Observations on the Influence of Electric Light on Vegetation," by Mr. C. W. Siemens. The society adjourned over the Easter recess to Thursday, April 8th, at half-past four in the afternoon.

GEOLOGICAL SOCIETY.

FEB. 20TH.—Annual General Meeting.—H. C. Sorby, Esq., President, in the chair.—The secretaries read the Reports of the Council and of the Museum Committee for the year 1879. The Wollaston gold medal was handed to Mr. H. Bauerman, for transmission to Prof. A. Daubrée; the Murchison medal and the proceeds of the Murchison donation fund to Mr. R. Etheridge; the Lyell medal to Mr. J. Evans; the balance of the proceeds of the Wollaston donation fund to Mr. T. Davies; and to Prof. Seeley the balance of the proceeds of the Lyell fund, for transmission to Prof. F. Quenstedt. The President then read his anniversary address. The ballot for the Council and officers was taken, and the following were elected: President, R. Etheridge; Vice-Presidents, Sir P. de M. Grey-Egerton, Bart., J. Evans, J. W. Hulke, and Prof. A. C. Ramsay; Secretaries, Prof. T. G. Bonney and Prof. J. W. Judd; Foreign Secretary, W. W. Smyth; Treasurer, J. G. Jeffreys; Council, Rev. J. F. Blake, Prof. T. G. Bonney, W. Carruthers, Sir P. de M. Grey-Egerton, Bart.. R. Etheridge, J. Evans, Lieut.-Col. H. H. Godwin-Austen, J. C. Hawkshaw, H. Hicks, W. H. Huddlestone, Prof. T. M'K. Hughes, J. W. Hulke, J. G. Jeffreys, Prof. T. R. Jones, Prof. J. W. Judd, Prof. N. S. Maskelyne, J. Morris, J. A. Phillips, Prof. J. Prestwich, Prof. A. C. Ramsay, Prof. H. G. Seeley, W. W. Smyth, and H. C. Sorby.

FEB. 25TH.—R. Etheridge, Esq., President, in the chair.—Messrs. J. H. Cowham, W. A. Forbes, M. H. Gray, and C. T. Whitmell were elected Fellows. The following communications were read: "On the Geology of Anglesey," by Prof. T. M'K. Hughes; "Notes on the Strata exposed in laying out the Oxford Sewage-Farm at Sandford-on-Thames," by Mr. E. S. Cobbold; and "A Review and Description of the various species of British Upper-Silurian Fenestellidæ," by Mr. G. W. Shrubsole.

MARCH 10TH.—R. Etheridge, Esq., President, in the chair.—Mr. J. Ward was elected a Fellow; and Prof. F. von Hochstetter, of Vienna, and Prof. A. Renard, of Brussels, foreign correspondents of the society. The following communication was read: "On the Geological Relations of the Rocks of the South of Ireland to those of North Devon and other British and Continental Districts," by Prof. E. Hull.

SOCIETY OF ANTIQUARIES.

FEB. 26TH.—E. Freshfield, Esq., V.P., in the chair.—Notice was given of a ballot for the election of Fellows on Thursday, March 4th. Mr. R. Nevill exhibited an inscribed block of terra-cotta 8 in. by 11½ in. in surface. and 8 in. deep, which came from the old gatehouse at Esher Place, Surrey, to which Cardinal Wolsey was at first banished. It is not, however, certain that it belonged to the house. On the face of it was a buckle, the Pelham bade, and around the buckle was the legend, LAN DE GRACE 1534 FUT CEST MAYSO FAICTE. In the centre of the badge are the letters W. P., which no doubt are intended for Sir William Pelham, of Sussex, who succeeded to his estates in 1516, and died in 1538. Mr. W. K. Foster exhibited a pair of brass snuffers of the sixteenth century, found in a house at Bishop's Stortford, and a tobacco stopper, with a head of Charles I. The snuffers very closely resemble a pair figured in the "Catalogue of Works of Art and Antiquity," published by the Company of Ironmongers (p. 224). Commander Telfer exhibited a bronze plaque or bas-relief, representing the entombment of our Lord. Mr. G. L. Gomme, F.S.A., read a paper "On Open-Air Courts of Hundreds and Manors." After claiming for his study the adaptation of a new title, namely, "Primitive Politics," Mr. Gomme proceeded to give a summary of the special value attached to the subject of open-air courts. By the custom of holding assemblies in the open air being found to exist among many primitive peoples, it was shown that it belonged to primitive life, and that, therefore, the examples to be met with in England at the present day were really survivals of a primitive stage of society. Limiting the present paper to examples of courts of hundreds and manors only, Mr. Gomme investigated the following hundred courts: Humbleyard, Clackclose, Taverham, Grimeshou, Forehou, Greenhoe, Smethdon, Freebridge, Gallow, Lynford, Depewade, Mitford, Erpingham, Launditch and Earsham in Norfolk, Stone in Somersetshire, Alwicke and Younsmere in Sussex, Swanborough in Wilts, and Knightlow in Warwickshire. The manor courts were shown to give evidence of the assembly of the primitive village community, and Mr. Gomme enumerated Aston in Oxfordshire, Somerton in Somersetshire, Pamber in Hampshire, Rockford in Essex, Warnham in Sussex, and many others.

MARCH 4TH.—E. Freshfield, Esq., V.P., in the chair.—This being an evening appointed for the ballot, no papers were read; but Mr. Freshfield exhibited his own collection of Sarum Missals and Manuals, early Primers, Primers, Prayer Books, Bibles, Acts of Parliament, Injunctions, and the like, connected with the history of the Book of Common Prayer. Mr. Micklethwaite also exhibited some illuminated leaves of a Latin service book noted, which had been adapted for post-Reformation use, all allusions to the Papacy being erased. In consequence of the lack of vacancies, only two candidates were elected, viz., Mr. S. W. Kershaw and Mr. E. M. Thompson. The latter gentleman was proposed by the Council.

MARCH 11TH.—F. Ouvry, Esq., V.P., in the chair.—The Rev. W. C. Lukis laid before the society his Report on the Prehistoric Monuments of Devon and Cornwall, which he had visited, explored, and planned last summer at the request of the Council, and with the pecuniary aid of the society. The report was illustrated by thirty-six large sheets and twenty-seven smaller sheets of careful plans and drawings to scale, the result of the accurate survey and measurements of fifty-six monuments, consisting of twelve monoliths, one line of monoliths, eleven holed stones, thirteen large circles, seven cromlechs, four chambered barrows, four cisted barrows, and four dwelling enclosures. Of all these monuments Mr. Lukis laid before the society an interesting tabulated report, drawn by Mr. W. C. Borlase (to whose assistance in surveying the prehistoric monuments of Cornwall Mr. Lukis said he was deeply indebted), giving a list of the monuments in the order in which they were planned; the names, if any, by which they were popularly known; the parishes in which they are situated, and how they may be reached; the proprietors' names and residences; the printed books and MSS. in which they are described; and the discoveries which have been made in or near them. On the value of such a list it is needless to insist. The same may be said with still greater force of the plans which lay upon the table in profusion. These monuments are in daily danger of being mutilated or destroyed altogether; and a series of plans such as these, so carefully executed—but only if carefully executed—preserves a faithful record of them in the condition in which they are now, and furnishes means of comparison with the monuments of other countries and races. While Mr. Lukis was reading his paper, the president, the Earl of Carnarvon, entered the room, from which illness had for many months kept him away, and was warmly received by the Fellows. He came from the House of Lords to announce that Sir J. Lubbock's Bill had for all practical purposes been thrown out that evening, having been referred to a Select Committee. The two principal reasons for the opposition it had met with were, (1) the interference which the Bill, as it was alleged, exercised with the rights of private property, and (2) the machinery by which it was proposed to work the Bill, viz., the trustees of the British Museum. With Mr. Lukis's plans on the table it was impossible not to feel that the publication of such a series of the prehistoric monuments of this and other countries would be the most efficacious substitute for a measure which, after a seven years' struggle, had been passed with such difficulty through the House of Commons, and had virtually been thrown out in the House of Lords. As Lord Carnarvon observed in his anniversary address last year, the real point to aim at is an archæological survey of Great Britain. No measure for the preservation of ancient monuments can be really efficacious until it be known what they are, where they are, and whose they are. In reply to Mr. Borlase, who expressed a wish that the plans then exhibited should be published, the Director stated that the matter of such a publication had been very fully considered by the council, and that estimates had been obtained. He hoped if the project met with adequate support that the council might see their way to carry it out. The great result of Mr. Lukis's report, and of all the other plans he has executed, goes to show that "all now uncovered dolmens were once enclosed in barrows; that none were erected as cenotaphs on the summits of artificial mounds; and that no such class as that which has been designated as earth-fast or demi-dolmen exists." Mr. Lukis proceeded to read a second paper on "Egyptian Obelisks and European Monoliths Compared." Egyptian obelisks served successively, and speaking roughly three purposes: first, they were sepulchral, and erected before the entrances of tombs; secondly, they were placed (in the eleventh and twelfth dynasties) before the temples of kings, and were no longer sepulchral; thirdly, they had a triumphal character, like the triumphal columns of the Romans. Mr. Lukis's object was to show that it was only in the first class, *i.e.*, of sepulchral monuments, that we must look for the counterparts of the rude monoliths of Europe—a theory which receives some not unimportant confirmation from the existence of ancient monoliths in churchyards, such as at Rudston, and at several places in France.

Mar. 18th.—E. Freshfield, Esq., V.P., in the chair. Mr. J. Clarke exhibited and presented an illuminated calendar of the fourteenth century, which had been described at the opening meeting of the Society (November 27th, 1879) by Mr. Freshfield.—The Rev. B. Webb exhibited an ancient antependium or altar frontal from Alverly Church, Salop. Such altar frontals of as early a date as this are extremely rare—indeed, Mr. Webb did not himself know of the existence of another. In the centre was a representation of "Abraham's Bosom," a quaint conceit, quaintly represented, Abraham holding with extended arms a cloth in which were the souls of the blessed.—The Rev. Canon Jackson exhibited, by permission of the Marquis of Bath, an early deed and seal, being a grant of land at "Hornlee and Horninton" (Oxon) from William de Colville to Bertram de Verdun. The seal, of which only a fragment remained, seemed to have on it a female effigy with long hanging sleeves; but across where the waist would come the field of the seal was traversed by a horizontal bar, a quarter of an inch wide, the significance of which was obscure.—Mr. C. S. Perceval communicated miscellaneous remarks on various seals, and more especially on those of Dartford Priory.

ROYAL SOCIETY OF LITERATURE.

Feb. 25th.—W. Knighton, Esq., in the chair. Mr. R. N. Cust, in a paper "On late Excavations in Rome," gave an account of the recent researches in that city, which have been mainly due to the energy and zeal of the Emperor Napoleon III, of Mr. J. H. Parker, and of the present Italian Government. In the course of a rapid but clear survey, Mr. Cust dealt especially with five particular portions of the area of Rome which have been the scene of successful explorations, viz.:—1, the Palatine Hill, the site of the house of Augustus and of the palaces of the later emperors; 2, the Forum; 3, the Baths of Titus and the Colosseum; 4, the Baths of Caracalla; 5, the banks of the Tiber within the city. The paper was illustrated by maps kindly lent for the purpose by Mr. J. H. Parker and Mr. J. Murray.

Mar. 17th.—Sir P. de Colquhoun, Q.C., in the chair. Mr. Wellsman, the editor of the *Newspaper Press Directory*, was elected a Fellow. Mr. J. W. Redhouse read a paper "On a Theory of the Chief Human Races of Europe and Asia," in which he combated the usually received views of the spread of the Aryan tribes north-west into Europe, and south-east into India, from the high plateau of Pamir in Central Asia. He based the theory that he advanced, viz., that they really came from the north-west Polar regions, on the consideration of the map and geology of the Old World of Europe, Asia, and Africa, guided by such fragmentary traditions of sudden upheavals or subsidences as have been more or less corruptly preserved and handed down to us, which seem to show the probability that this portion of the earth's surface may in some prehistorical age have consisted of several distinct continents, islands, or archipelagoes. Each of these must have been tenanted by a Fauna and a Flora nearly, if not quite, peculiar to themselves, just as America, Australia, and New Zealand were found to be when first discovered by Europeans. Certain it is that over this whole range a tropical climate must once have prevailed, and perhaps over the ideal lost continent also. Mr. Redhouse's paper was illustrated by six skeleton maps, showing the successive alteration of the earth's surface he considered most likely.

LINNEAN SOCIETY.

Feb. 19th.—W. Carruthers, Esq., V.P., in the chair. Mr. E. S. Baikie was elected a Fellow. Mr. J. Britten exhibited stems of *Myrmecodia echinata* and *M. glabra*, recently sent from Borneo by Mr. H. O. Forbes, showing the galleries formed by a species of ant allied to, if not identical with, *Pheidole Javana*, Mayr. Specimens of very young plants were also shown, all of which had been attacked by the ants. Signor Beccari, who had studied Myrmecodia in its native localities, asserts that the presence of the ants is essential to the plant's existence, for unless the young plants are attacked by the ants they soon die. Dr. M. Masters also brought forward a pitcher plant, *Nepenthes bicalcarata*, from Borneo, and read Mr. Burbidge's notes thereon. These pitchers are perfect traps to creeping insects from the incurved spinous ridges round the throat. To take advantage of the prey, a species of black ant ingeniously perforates the stalk, and thus provides a safe inroad and exit whereby to avail itself of the sumptuous fare of dead and decaying insects contained in the reservoir. The remarkable Lemureid, *Tarsius spectrum*, likewise visits the pitcher plants for the sake of the entrapped insects. These it can easily obtain from the *N. Rafflesiana*; but not so from the *N. bicalcarata*, where the sharp spurs severely prick if Tarsius dares to trifle with the urn-lid. Dr. J. E. T. Aitcheson read a paper "On the Flora of the Kurum Valley, Afghanistan." The 950 species collected point to the district in question being a common meeting ground of Perso-European, Chinese-Tibetan, and Himalayan floras. In the Kuram and Hariab Valleys the Deodar, our finest Himalayan timber tree, forms dense forests, doubtless valuable hereafter for exportation. *Chamærops Ritchiana*, a branching palm twenty feet high when uninjured, forms only an aloe-like scrub on the dry plateau west of the Darwaza Zar Pass. The author describes new species belonging to several genera, among others Acantholimon, Astragalus, Rosa, Rhododendron, &c. A dozen species or more of ferns were met with, and *Nephrodium rigidum*, most characteristic, was proved to have an Afghan residence. Dr. Aitcheson interspersed his technical data by interesting information concerning the native uses of the plants.

March 4th.—Prof. Allman, president, in the chair. The following gentlemen were elected Fellows:—Messrs. S. M. Bairstow, J. T. Carrington, R. M. Middleton, S. O. Ridley. T. C. White, and Prof. P M. Duncan Dr. Middleton exhibited two skulls of *Babirussa alfurus*, Less., from Borneo, which, though quite adult, were both distinguished by the unusual smallness of their tusks. Dr. Gunther brought forward two deep-sea fishes obtained during the Challenger expedition (Echiodon and Scopelus) to illustrate two kinds of luminous metameric organs, first distinguished by Dr. Ussow, which he described and designated as the lenticular and glandular kinds. Whilst admitting the great morphological resemblance of the former to an eye, he (Dr. Gunther) gave reasons which induce him to dissent from the view that they are organs of vision. He showed that their structure was not opposed to the view that they, like the glandular kind, are producers of light, and that probably this production of light or luminosity is subject to the will of the fish. Mr. J. Jenner Weir, on behalf of Mr. E. A. Nevill, showed the stuffed head of a prong-buck (*Antilocapra Americana*), shot by the latter in the Rocky Mountains in August, 1876. On the median nasal region of this specimen what appeared to be a short unbranched third horn was developed. On discussion of the abnormality, it was suggested as being rather an elongated warty growth than a true horn after the type of the rear ones; a further careful examination into its structural conditions was recommended. Mr. E. M. Holmes read a paper "On *Codiolum gregarium*, A. Braun, a new British Alga discovered at Teignmouth by the Rev. R. Cresswell." The author considered that the hypnospores described by Braun did not belong to Codiolum, but to another Alga usually found growing with it. The growth of the plant and its fructification, contrary to Braun's supposition, lasts through the winter and spring. Mr. Holmes also exhibited specimens of the fructification of *Chætopteris plumosa*, found in Britain for the first time by Mr. G. W. Traill, of Edinburgh. The unilocular sporangia in this instance were in a more advanced stage than those figured by Areschong, and the multilocular sporangia differed in character from the illustration given by the last-mentioned Swedish naturalist. Mr. F. Day briefly recounted the peculiarities and descanted on the geographical distribution of the Hebridal Argentine, a fish rarely met with in British waters, but nevertheless of considerable interest.

Mar. 18th.—Prof. Allman, President, in the chair. The death of Prof. T. Bell, a former President of the Society, was announced from the chair, and remarks made regarding his valuable labours as a zoologist, especially concerning British animals.—Mr. T. Christy exhibited a collection of dried flowers from Western Australia made by Mrs. Bunbury. She observes that the once common native flowers are becoming rapidly scarce in the pasture land of the colony, and that it is even difficult to propagate them by culture.—There were exhibited for Mr. J. T. Carrington a male and a female example of the Northern stone crab (*Lithodes Arctica*), which had lived in the Westminster Aquarium. The peculiar asymmetry of the abdominal segments of the female was adverted to, and from this and other reasons an affinity with the hermit crabs pointed out.—The Secretary read a communication from Mr. H. M. Brewer, 'On the Indigenous Timber and on Plants introduced into New Zealand.' Among the former, Manaka (*Leptospermum ericoides*) is useful for spokes, tool handles, &c.; Kowhai (*Sophora tetraptera*) forms admirable material for carving, &c.; Totara (*Podocarpæ totara*) is most durable for piles, railway sleepers, &c.; red birch (*Fagus fusca*), on account of its strength, is well adapted for beams and framework; and the Matai (*P. spicata*) is so durable that a prostrate tree found in damp bush, and supposed to have lain there for a couple of centuries, still retained its soundness when cut up. Of plants introduced quite a host thrive out of doors: among others the coral tree (*Erythrina caffra*), with its brilliant scarlet flowers, and *Fourcroyia gigantea*, which produces a fine fibre, as does also *F. flavaviridis*. *Chamærops excelsa*, *C. humilis*, *Musa textilis*, and *M. sapientum* equally thrive; the banana ripens good fruit. The pomegranate and olive hereafter are likely to become important commercial products. The Natal plum

(*Arduina grandiflora*), the fig, custard apple, ginger, the tallow tree (*Stillingia sebifera*), cinnamon, camphor, orange, lemon, citron, and many others, attest a climate and soil of great capabilities. A great number of species of pines and Auracarias thrive well, and oaks, elms, and poplars take quite naturally to the country.—A paper from Prof. Westwood, 'On a Supposed Polymorphic Butterfly from India,' was read. His results are in favour of, first, *Papilio Castor* being males of a species whose females have not hitherto been discovered; second, that the typical *P. Pollux* are females, of which the male, with rounded hind wings having a diffused row of markings, has yet to be discovered; and third, that the coloured figures shown by the author represent the two sexes of a dimorphic form of the species.

BRITISH ARCHÆOLOGICAL ASSOCIATION.

MARCH 17TH.—Mr. H. Syer Cuming in the chair. It was announced that the "Thinghow," a curious artificial hill at Bury St. Edmunds, had been opened, and had proved to be a large British barrow. Other interesting discoveries at Winchester and at Wolvesley Castle were announced.—Mr. J. Brent described a Saxon interment which has been recently found at Canterbury, and which contained various bronze articles of unusual form.—Mr. Way reported further discoveries of Roman pottery and other articles at King's Arms Yard, Southwark, and among these was a fragment of a pavement, showing that the site was that of a building, probably a villa.—Mr. L. Brock described to Roman bronze statuettes, of Hercules and Venus respectively, and Mr. G. G. Adams a finely carved crucifix and a religious painting of Flemish work, dated 1645.—Dr. Kendrick exhibited a vessel in form of a bull, of terra cotta of early Spanish work, and not unlike in design some rare examples of English make.—The first paper was by Mr. T. Morgan, 'On certain Grants of Land in Mercia in 770.' The lecturer referred to the description by Mr. de Gray Birch of a little known charter belonging to the Dean and Chapter of Worcester, in which reference was made to the granting of land for three lives by King Offa; afterwards the land, which belonged to the Church, was to revert to the Church. The crippling of the king's resources by so much land being in Church patronage was alluded to, and it was supposed that the grant was made by Offa to equalise this, after the manner of similar acts by Charlemagne. Many curious references were pointed out, allusions to boundaries of estates, the offices of Regulus and Sub-Regulus, and especial reference was given to the little studied transition of municipal governmeut from Roman times to Saxon.—The second paper was by Dr. R. A. D. Lithgow, 'On the Orthography of Shakspeare's Name." It was founded on the lately privately-printed pamphlet by Mr. Halliwell-Phillipps, and advocated in a similarly conclusive way the long mode of spelling the name. Mr. Wright afterwards referred to Mr. Halliwell-Phillipps's suggestion that that the hitherto thought "s" in the famous signature of the will is, after all, the well-known contraction for "es." If so, this conclusively settles the question in favour of the name being spelled the long way by Shakspeare himself.

METEOROLOGICAL SOCIETY.

FEB. 18TH.—Mr. G. J. Symons, Esq., president, in the chair. Dr. J. S. Cameron, Dr. F. F. Carey, Messrs. J. B. Charlesworth, A. Collenette, S. Forrest, J. G. Gamble, H. J. Marten, J. Hixon, W. P. Propert, S. Rostron, W. P. Swainson, and E. W. Wallis were elected Fellows. The papers read were "On Typhoons in China, 1877 and 1878," by Lieut. A. Carpenter, R.N.; "Note on the Reports of Wind Force and Velocity during the Tay Bridge Storm, Dec. 28th, 1879," by Mr. R. H. Scott. These reports seemed to show that the velocity of the wind on that occasion was not so high as was generally supposed, and had been frequently exceeded, but that some of the gusts were very violent; and "On the Frost of December, 1879, over the British Isles," by Mr. W. Marriott.

MARCH 17TH.—Mr. G. J. Symons, presidenl, in the chair. Sir A. P. B. Chichester, Mr. W. H. Cochrane, Rev. H. Garrett, Mr. H. Jonas, Mr. J. Lingwood, Lieut.-Col. L. W. Longstaff, Rev. C. E. Sherard, Mr. J. H. Stewart, and Dr. W. J. Treutler were elected Fellows. The following papers were read:—"Thermometric Observations on board the Cunard R.M.S.S. Algeria," by Capt. W. Watson; and "On the Greenwich Sunshine Records, 1876 80," by Mr. W. Ellis.

INSTITUTION OF CIVIL ENGINEERS.

MARCH 2ND.—Mr. Brunlees, V.P., in the chair. The monthly ballot resulted in the election of Messrs. A. Ellis and H. J. Fraser as members; of Messrs. F. Abercrombie, A. W. T. Bean, G. Berkley, jun., P. W. Britton, C. W. Bryden, G. S. Campbell, A. B. Holmes, A. W. Itter, A. Pine, J. N. Taylor, A. B. Todd, J. H. F. Townsend, T. Tully, and L. H. Whitmore as associate members; and Lieut. H. E. M'Callum as an associate.

MARCH 9TH.—Mr. W. H. Barlow, president, in the chair. The paper read was "On the Purification of Gas," by Mr. H. E. Jones.

MARCH 23RD.—Mr. W. H. Barlow, F.R.S., president, in the chair. The paper read was "On Explosive Agents applied to Industrial Purposes," by Prof. Abel.

QUEKETT MICROSCOPICAL.

FEB. 27TH.—Dr. T. S. Cobbold, president, in the chair. Five new members were elected. A paper "On Bleaching and Washing Microscopical Sections," by Mr. S. Marsh, was read by the secretary. Mr. Gilbert pointed out some of the disadvantages which attended bleaching, and Dr. Matthews recommended the increased use of polarised light as a means for the differentiation of tissues. The president read a paper entitled "Observations on Human Filariæ," in which he gave an account of a remarkable series of investigations conducted by Dr. Manson in China, and by other medical gentlemen in that country and in India, which tended to show that in persons afflicted by these parasites the blood was comparatively free from them during the day, but swarmed with them at night, especially during those hours when mosquitoes bit most freely. The life history of the Filaria during its five days' development in the body of the mosquito was described and illustrated by numerous diagrams and specimens. An improved form of turntable was exhibited and described by Mr. Dunning.

ANTHROPOLOGICAL INSTITUTE.

FEB. 24TH.—E. B. Tylor, Esq., president, in the chair. Mr. J. H. Gladstone was elected a member. Dr. Tylor read a paper "On the Origin of the Plough and the Wheeled Carriage." The first agricultural implement seems to have been a pointed stick four or five feet long, such as many savage tribes still carry for the purpose of digging roots, knocking down fruits, and unearthing animals; at a later date the stick was bent and used hoe fashion, the point being hardened by fire. The Indians of North America still use it in this fashion. In South Sweden large tracts of land give evidence of early culture, which is attributed by the natives to a prehistoric people, called by them "the hackers," whose rude hoe was a fir pole with a short projecting branch pointed, and who are always associated with the giants of mythology. There came into use afterwards a larger instrument of the same kind, which was not used like the hoe, but was dragged by men or oxen. Instances of this are to be found in the old Egyptian pictures and among the bas-reliefs, and it is evidently the primitive idea of the plough. The plough in its origin is prehistoric, evidences of its early use being found amongst the Greeks, Egyptians, and Chinese, and it had from the earliest times a religious sanction, one proof of which is found in the fact that the name of Brahma's wife, Lita, signifies a furrow. A wooden hook shod with iron was the next improvement, and in the time of Virgil we find a wheeled plough in use which differed little from the best in Europe a century ago. Some people assert that the plough was the earliest vehicle, but it seems more probable that the sled was first used, next rollers were placed underneath and shifted forward when necessary, as seen in one of Raphael's pictures in the Vatican, and then the middle part of the rollers was shaved away in order to reduce the friction. In some carts of the Scythians the solid drum wheel is fixed to the axle, so that wheel and axle revolve together; and in Italy and Portugal at the present day the carts are very generally built with large block drum wheels, and in many cases the bearings are not locked below, but merely rest on the axle, like forks. The original mode of harnessing was the yoke, attached to the horns or withers of oxen. In the time of Homer no traces were used; but the Egyptians used one trace, which shows that they were one stage further advanced in civilisatiou. The Gauls and Britons evidence a still greater advance in the employment of chariots, some even furnished with scythes, like those mentioned in Maccabees. Dr. Dally exhibited a fine collection of ethnological objects from British Columbia. On some of the hats which were shown Dr. Dally pointed out marks similar to the tattoo marks with which the natives adorn their bodies, and which, he said, all have a definite meaning, being in fact a record of events which have taken place in the life of the wearer. Some of the specimens of native workmanship were remarkably good, particularly some silver bracelets, which had been made and engraved specially for Dr. Dally. The natives appear to have a knowledge of working iron and brass as well as the softer metals.

MARCH 9TH.—F. Galton, Esq., V.P., in the chair. Mr. G. Morrison was elected a member. Mr. F. Galton described the curious psychological fact on which he wrote a preliminary memoir in *Nature* on January 15th. He found that about one in every thirty adult males or fifteen females not only see numerals in a vivid mental picture whenever they think of them, but that each number is always seen in the same definite position in their mental field of view. Consequently, when they think of a series of numerals, 1, 2, 3, 4, 5, 6, &c., they are always mentally seen as if ranged in a regular pattern or form. These forms are invariable in the same individual; they date, in all cases, further back than recollection extends, they are very vivid, and quite independent of the will. They are of fantastic shapes, but no clue can be suggested as to their precise origin; they differ extremely in different people. Mr. Galton exhibited a collection of nearly sixty of these forms, furnished to him by friends and correspondents, whose descriptions of their general characters were curiously consistent and corroborated one another. All this is difficult to understand by the great majority of persons who cannot visualize, but these should never assume that others cannot have a mental habit in which they themselves are deficient. Several of Mr. Galton's correspondents testified to their respective forms, viz., Mr. G. Bidder, the Rev. G. Henslow, Mr. Schuster, Mr. Roget, Mr. B. Woodd Smith, and Colonel Yule. Mr. Henslow and Mr. Schuster saw their forms objectively, and could point to the direction and specify the apparent distance at which they saw them, but they appeared to the other gentlemen, as it were, in dreamland, without relation to external space. Mr. Galton showed that these forms were survivals of the mental processes of the child before the time when he could read, and connected their lines with those that govern handwriting and gesture, architecture of animals, and their characteristic movements. He also showed how marked were the traces of the mental conflict in the child between the verbal and visual system of arithmetic between ten and twenty. What the ear perceives as "ten," "eleven," &c., the eye reads as "one-nought," "one-one," &c. Accordingly the forms twist and bend at the tens and twelves, and are further modified at the "teens." He thought from trials on his own mind that this conflict existed throughout life, and believed that our barbarous nomenclature was a serious bar to the ready acceptance of a decimal system of weights and measures. This habit of seeing numerals in forms is strongly hereditary. Mr. Gill exhibited a number of photographs of Australian aborigines.

Mar. 23rd.—E. B. Tylor, Esq., President, in the chair. A paper by Mr. V. Ball, 'On Nicoberese Ideographs,' was read. As the Adamanese may be said to have not progressed in civilization beyond that stage which was represented by the people of the early stone periods in Europe, so the Nicobarese, who are much less savage and degraded than their neighbours of the Andamans, may justly be compared with the inhabitants of the bronze period. The example of Nicobarese picture writing described by the author was obtained in the year 1873, on the island of Kondul, where it was hanging in the house of a man who was said to have died a short time previously. It is now in the Museum of Science and Art at Dublin. The material of which it is made is either the glume of a bamboo or the spahte of a palm, which has been flattened out and framed with split bamboos. It is about three feet long by eighteen inches broad. The objects are painted with vermillion, their outlines being surrounded with punctures, which allow the light to pass through. Suspended from the frame are some cocoa-nuts and fragments of hog's flesh. The figures, of the sun, moon, and stars occupy prominent positions.—Attention was directed to M. Maclay's description of a Papuan ideograph, which symbolized the various guests present at a feast given in celebration of the launch of two large canoes (*vide Nature*, vol. xxi. p. 227.)—Mr. A. Tylor read a paper 'On a New Method of expressing the Law of Specific Changes and Typical Differences of Species and Genera in the Organic World, and especially the Cause of the particular Form of Man.' The lower animals have no abstract ideas, and therefore all they can know must be derived from objects. Their reproduction of specific form and decoration seems to prove that they possess a mental power of appreciating the niceties of form and colour in a very high degree. The forms and decorations of organized beings seem to be regulated by laws which the author provisionally called emphasis and symmetry. Emphasis was defined as the marking out by form or decoration of the important parts or organs. It is a remarkable fact, and one that can scarcely be accidental, that just as animals fall naturally into two great classes, the vertebrata and invertebrata, so the emphasized functional decorations group themselves into two classes, and these two classes are identical with the vertebrata and the invertebrata. In the vertebrata the emphasized ornamentation is what we may call axial, being the outward expression of the central axis or vertebral column with its appendages; and in the invertebrata the decoration tends to follow the outline of the animal and so developes borders. It has always excited wonder that the child—a separate individual—should inherit and reproduce the characters of its parents, and indeed of its ancestors; but if we remember that the great law of all living matter is that the child is *not* a separate individual, but a part of the living body of the parent up to a certain date, when it assumes a separate existence, then we can comprehend how living beings inherit ancestral characters, for they are parts of one continuous series, in which not a single break has existed or can ever take place. Mr. Tylor's paper was illustrated by a large number of diagrams.

MICROSCOPICAL SOCIETY.

March 10th.—Dr. Beale, President, in the chair. Fifteen gentlemen were nominated or elected Fellows. Mr. Beck exhibited an improved form of microscope with swinging substage, Mr. Mayall a new traverse lens by Mr. Tolles, Mr. Dunning a new form of turntable, Dr. H. Gibbes a one-twelfth homogeneous immersion objective. for use with the binocular, and Mr. Crisp Klonne & Müller's demonstration microscope and a specimen of micrometric ruling by Prof. Rogers, of Harvard, U.S.—Mr. J. Smith described his method of illumination for high powers.—The following papers were read: On a Sponge Parasitic within *Carpenteria raphidodendron*,' by Prof. M. Duncan, 'On a Petrographical Microscope,' by M. Nachets, 'On Double and Treble Staining of Animal Tissues,' by Dr. H. Gibbes, and 'On *Podophyra quadripartita*,' by Mr. Badcock.

PHYSICAL SOCIETY.

Feb. 28th.—Prof. W. G. Adams in the chair. Mr. Ridout read a paper "On some Effects of the Vibratory Motion in Fluids," and a paper "On the Pneumatic Experiment of M. Clement Desormes." Dr. C. W. Wright read an exhaustive paper "On the Determination of Chemical Affinity in Terms of Electromotive Force."

CHEMICAL SOCIETY.

March 30th. — Anniversary Meeting.—Mr. Warren De La Rue, President, in the chair. The President in his annual address contrasted the condition of the Society during the past year with its position in 1869. The number of Fellows has increased from 522 to 1,034; the income from £1,100 to £2,700; the papers read from thirty-one to seventy-five. A rapid glance was then taken at the recent progress of chemistry, especial reference being made to the decomposition of the elements chlorine, bromine, &c., by Meyer; the photographs of the whole of the spectrum recently made by Capt. Abney; the artificial production of the diamond by Hannay; the synthesis of vegetable colouring matters and alkaloids; the discovery of a new element, Scandium, &c. The officers for the ensuing year were then balloted for. The President elected was Prof. Roscoe; and the Secretaries, Mr. W. H. Perkin and Mr. H. E. Armstrong.

Mr. James A. Stout, of Belleville, Ill., has patented a traction engine in which the propelling power is applied directly to an adjustable front axle, and the axle is provided with a universal or ball joint motion. The boiler is of novel construction, and designed with a view to economy and safety.

An improved rock drill, patented by Mr. John Brown, of Ishpeming, Mich., is so constructed that the piston and tool may be rotated by the entering air or steam, and that the entrance and exit of the air or steam will be controlled by the movements of the piston.

EXPLOSIVE AGENTS APPLIED TO INDUSTRIAL PURPOSES.

By Prof. Abel, C.B., F.R.S., Assoc. Inst. C.E., &c.

In this paper, which was read at a recent meeting of the Institution of Civil Engineers, the president, Mr. W. H. Barlow, F.R.S. (a Council Member of the Inventors' Institute), being in the chair, the author pointed out that since this subject had been brought by him before the institution in 1872 the advantages of explosives more violent in character than gunpowder for many important industrial uses had become so widely known and extensively utilised that the supremacy of gunpowder, as the only practically useful and economical blasting agent, had for some time been a thing of the past. The greatly superior results furnished by dynamite, gun-cotton, and other explosive agents of the same class, when applied to work in which their rending and shattering action was valuable, had led to the replacement of powder by them in many directions. It had also had the effect of rendering miners more critical in regard to the quality of blasting powder, a result which had operated beneficially, not only by requiring the bestowal of greater care upon the manufacture of blasting powder, but also by leading to improvements in the nature and form of powder. An improved blasting powder of Messrs. Curtis and Harvey was referred to as one illustration of this. An account was given of the advantages attending the employment of compressed powder, in the form of the charges first devised by Messrs. Davey and Watson, and manufactured by Messrs. John Hall and Son, which were rapidly coming into extensive use, and which presented unquestionable advantages over granular powder on the score of convenience and comparative safety as well as of greater efficiency. Other improvements in the application of gunpowder having been referred to, the author proceeded to examine into the progress which had been made in the production and application of preparations of gun-cotton and nitro-glycerine, observing that but few of the many proposed substitutes for gunpowder, to which he had alluded in 1872, had received any important applications.

The advantages attending the employment of wet gun-cotton were described, and the manner in which its detonation was brought about was examined; the theory of the development of detonation, as distinguished from explosion, and of its transmission, being incidentally discussed. Various important technical applications of wet gun-cotton, dynamite, &c., were referred to as illustrating the utilisation of the comparatively instantaneous character of detonation. It was pointed out that the safety, power, and comparative simplicity attending the application of wet gun-cotton to the larger operations for which violent explosives were valuable, had led to its adoption for submarine mines, torpedoes, and military engineering operations generally. On the other hand, compressed gun-cotton, employed either wet or dry, was now only used to a limited extent as a blasting agent, chiefly in the form of preparations sold under names by which their actual nature was disguised. Thus a variety of nitrated gun-cotton, converted into compressed charges similar to the original compressed pure and nitrated gun-cotton, was supplied to the miner under the name of tonite, and its employment as an efficient blasting agent was gradually extending. An account was given of the rapid progress which had been made in the application of the nitro-glycerine and Kieselguhr mixture, called dynamite, to the exclusion of other plastic nitro-glycerine preparations. The employment of dynamite upon a large scale was illustrated by reference to the stupendous operations connected with the destruction of the reef at Hell Gate, in East River, New York, when a total of 49,915 lbs. of dynamite and other nitro-glycerine preparations was exploded in one single operation. The objections to the employment of nitro-glycerine in the pure liquid state were pointed out. Reference was made to the tendency of dynamite to freeze, and the necessity for thawing it before use, as a prolific source of fatal accidents in connexion with mines and quarries, owing chiefly to recklessness of the men and their disregard of caution and instructions. In the course of the paper the author referred repeatedly, and in strong terms, to the mischievous and frequently disastrous effects of misleading statements with respect to the safety of particular explosive agents, such as the absence of noxious gases in connexion with their use, &c., which had from time to time been published and circulated in mining districts by the manufacturers and vendors, and which not only engendered false ideas of safety, but also encouraged the natural tendency to disregard precautions.

An account was next given of a new class of nitro-glycerine preparations, devised by Nobel, of which the so-called blasting gelatine was the type, and which presented such decided advantages over dynamite in several directions that they had already, to an important extent, supplanted it on the Continent, and promised to extend greatly the safe and efficient application of nitro-glycerine. In giving an account of the properties of blasting gelatine, and of certain difficulties which had to be overcome in its application, the author described a series of experiments he had made with the view of increasing the relative power, &c., of the more important explosive agents. Reference was also made to useful practical results which attended investigations on the transmission of detonation to considerable distances. The paper concluded with a review of the beneficial results in connexion with the manufacture, transport, storage, and use of explosive agents which had attended the judicious application of the measures included in the Explosives Act of 1875 ; and with these comments, on the one hand, on the necessity for increased activity on the part of local authorities in some directions in connection with the Act, and, on the other hand, on the danger to the public and to commercial interests, resulting from the persistent refusal of railway authorities to facilitate the legitimate transport of explosives.

INVENTORS' INSTITUTE.

THE following is the detailed description, extracted from the specification of the patent of Mr. Turnbull's invention, which was brought before the Inventors' Institute at the meeting, 8th April, 1880 :—

These improvements in steam engines, surface condensers, and valves are as follows :— To improve the construction and increase the economy of steam engines I dispense with crosshead connecting-rod, &c., and connect the piston and crank together by each end of the piston rod through a movable stuffing-box, which is fitted to or cast on a plate that moves steam tight on the surface of the cylinder cover, which is made convex, and has an oblong opening to suit the oscillation of the piston-rod caused by the motion of the crank. The pressure and friction produced by the angular thrust of the piston-rod is counteracted by admitting steam between the piston and cylinder on the side where the pressure is by a small self-acting valve fitted into the piston. By this improvement the number of parts and friction is greatly reduced.

The second part of my improvements is to increase the economy of steam in compound engines with two or more cylinders. The exhaust steam of each cylinder passes to the condenser or atmosphere according to the type of engine. When two cylinders are used the cranks are fixed from 90 to 120 degrees apart, and when three cylinders are used the cranks are fixed from 100 to 120 degrees apart. The steam from the boiler is supplied to the small cylinder through suitable steam passages and valves, which are worked from a separate link motion which regulates the steam required for the engine. When the piston of the small cylinder has performed part of the stroke the steam is transmitted from the pressure side of the piston by an intermediate valve or valves into the steam chest of the large cylinder or cylinders. The intermediate and steam valve work in unison at full, though from separate, link motions, and are connected to the same reversing shaft. In starting the engine all the valves can be worked from the same reversing lever when sufficient steam has been transmitted to the large cylinder or cylinders, the steam valve recloses, and the intermediate valve or valves opens the communication between the small cylinder and condenser.

The third part of my improvements in steam engines is to increase the expansion of the steam in engines fitted with link motions by regulating the opening of the expansion valves from the lever on the reversing shaft, that suspends and varies the position of the link, or from a lever specially fixed on the reversing or intermediate shaft, as may be most convenient, or the expansion of the steam is increased. In engines fitted with link motions by working an exhaust valve within the steam valve from the valve spindle of the same, which has a screw cut on it of suitable pitch to cause it to rotate and move the exhaust valve alternately to each end of the steam valve, by which the steam is maintained on the propelling side of the piston longer than in engines worked by the ordinary valve and link motions, it likewise greatly reduces the excessive compression of the steam on the exhaust side of the piston in engines working at a high grade of expansion.

The fourth part of my improvements is for the continuous cooling of the water for condensing the exhaust steam in locomotive and other engines by forcing the water into spray by an ejector in a tank or tender through which the air passes. Instead of distributing the water over a series of tubes, as in my patent of Aug. 15, 1877 (No. 3112), I distribute it in a tank without tubes, through which the air passes, and the vapour that arises from the water I condense in another part of the tank fitted with tubes, or in a separate vessel with tubes : the exhaust steam is drawn by the ejector into contact with the condensing water. To prevent any evaporation, I place an absorbent material over the opening to the atmosphere ; part of the condensing water is returned to the boiler. In other engines the air is forced or drawn by a blowing or exhausting fan through the tubes. Or I convey the exhaust steam by an ejector into contact with the condensing water, which is forced into spray over tubes, fitted water-tight in a tank through which the air passes. The air and feed water is treated as before described. I likewise condense the exhaust steam in locomotive and other engines by exhausting it among a series of tubes, made steam-tight in the tank or tender through which the air passes. The vapour and water from the condensed steam I remove by an air pump, and return the condensed water to the boiler. In stationary engines the air is forced or drawn through the tubes of the condenser by a blower or exhausting fan. By these improvements a vacuum is formed which greatly increases the effective power and economy of the steam.

1. I claim the method of directly coupling the crank and piston together by each end of the piston rod as described.

2. I claim the intermediate valve in the steam chest for transmitting the steam from the small cylinder to the large cylinder or cylinders, which likewise discharges the exhaust steam from the small cylinder to the condenser.

3. I claim the self-acting valve in the piston for neutralising the angular thrust of the piston-rod against the side of the cylinder.

4. I claim the use of the packing pieces between the piston rings.

5. I claim the method of varying the expansion valves for regulating the amount of steam required in the engines from an arm on the reversing or immediate shaft as described.

6. I claim in engines fitted with link motions an exhaust valve within the steam valve worked from the spindle of the same, for increasing the expansion of the steam.

7. I claim the various methods described for cooling the water and condensing the exhaust steam in locomotive and other engines.

USE OF ASPHALT AND MINERAL BITUMEN IN ENGINEERING WORKS.

By W. H. DELANO, Assoc. Inst. C.E.

UNDER the above title a paper was read at a recent meeting of the Institution of Civil Engineers, Mr. Brunlees (vice-president) in the chair, the official abstract being this :—

Adopting the nomenclature of M. Léon Malo, which had received general sanction, the author considered asphalt as a combination of carbonate of lime and mineral bitumen produced by natural agency. Asphaltic mastic was the rock ground to powder, and mixed with a certain proportion of bitumen. Gritted asphalt mastic was asphalt mastic to which clean sharp sand had been added. Asphaltic or bituminous concrete was gritted asphalt mastic, mixed when hot with dry flint or other stone. Boussingault's analysis of bitumen gave C_{85},H_{12},O_3. It was, therefore, an oxygenated hydro-carburet, and quite distinct from the preparations of gas tar and pitch, which were sometimes erroneously styled bitumens and asphalts. It was important that these distinctions should be borne in mind when specifying asphalt, as their disregard might lead to the employment of a material having few of the properties of the natural rock, although bearing to the uninitiated a strong resemblance thereto. Messrs. Hervé-Mangon and Durand-Claye, of the Ecole des Ponts et Chaussées, Paris, had supplied the author with detailed analyses of different kinds of natural asphalts, which were given in the paper, and specimens were exhibited. But beyond knowing the numerical value of the proportionate constituents, it was highly necessary that the engineer should be acquainted with their quality. Asphalts which gave almost identical analyses might in practice yield widely different results, if the nature of the individual components was dissimilar. Powdered limestone should be white and soft to the touch ; if rough, it probably contained iron pyrites, silicates, crystals, &c. The presence of these substances was prejudicial, and if suspected the limestone should be subjected to a secondary analysis, directions for which were given. The proportion of bitumen to limestone in the natural asphalt should not exceed 10 per cent. for carriage ways, indeed less than that was preferable. For this latter purpose no asphalt should be specified which had not stood the test of, at least, three hot summers and three cold winters. These precautions being taken, the author was of opinion that a well-laid surface of compressed asphalt, 2 to $2\frac{5}{8}$ inches thick, on a foundation of Portland cement concrete, 6 to 9 inches thick, was superior to all other carriage-ways. It was noiseless ; hygienic, being impervious to urine and the liquids from dung ; absorbed vibration ; produced neither dust nor mud ; was cheap, durable, and easily repaired, and the old materials could be used again. The charge of slipperiness, which had been made against asphalt roadways in London, was not due to the material but to the absence of provisions for proper scavenging. In Paris, where the asphalt was regularly scraped, washed, and swept, the complaint did not arise. In support of the assertion that climate did not affect the asphalt in London, a table of humidity was given showing the means of six years (1873-8) observations to be—for Paris, 80·2 ; for London, 81·5. The cost of washing the roadways, when done systematically and on a large scale, was much less than was generally supposed, and the advantages far more than counterbalanced the expense. The author submitted a design for a portable washing and sweeping machine for use in London. Reference was made to the cost of compressed asphalt carriage-ways. In Paris this amounted on the average to about 13s. per square yard on lime concrete 4 inches thick, but a thickness of 6 to 9 inches of Portland cement concrete was much preferable. The cost of transport of the material also exercised an important influence on the ultimate expense. Details were given of various works of asphalt paving carried out by the author, with particulars of the cost of maintenance.

The quality of absorbing vibration, which was a marked characteristic of asphalt roadways, had been taken advantage of in the application of the material for the foundations of machinery running at high speeds. This was instanced in the case of a Carr's disintegrator, which, being mounted in a pit lined with bituminous concrete, was worked at 500 revolutions per minute without sensible tremor, whereas with the former wooden mountings on an ordinary concrete base the vibration was excessive, and extended over a radius of 25 yards. In the Paris Exhibition of 1878 there was shown a block of bituminous concrete, weighing 45 tons, forming the foundation of a Carr's disintegrator used as a flour-mill, and making 1,400 revolutions a minute, a speed which would have been impracticable on an ordinary foundation. Extensive applications of the material for this purpose obtained in France, especially in connection with steam-engines and steam-hammers.

Another use of asphalt was for the flooring of powder-magazines, where its non-spark-emitting character made it particularly valuable. It was also largely applied in France in the form of gritted mastic for the flooring of casemates in fortifications, and in its pure liquid form for the coating of vaults and arches, where it protected the masonry from damp, and the subsequent disintegration caused by infiltration and by frost.

In conclusion, the author referred to the imitation asphalts occasionally brought forward, and by some regarded with favour on the score of cheapness. The best of these, if properly made, was as dear as the natural material, without in any degree possessing its special qualities of appearance and durability ; and in no case were any of them suited as paving materials to resist heavy traffic. In Paris the tricks of irresponsible paving contractors were many, and necessitated constant vigilance. Inferior cement was put into casks bearing established brands, and the concrete made with such cement was put down in thinner layers than was paid for. The author had even known cases where the concrete was omitted altogether, a layer of common mortar taking its place. Such foundations would ensure the failure of the best asphalt, which ought to be considered only as a wearing surface or armour to the concrete. But the mode most difficult of detection was the ostentatious display at the site of the works of cakes of the particular asphalt specified, while an inferior material was in the boilers. Once laid wear alone would reveal what had taken place. From these malpractices asphalt had occasionally suffered unmerited condemnation, but the author claimed that with *bonâ fide* materials and workmanship satisfactory results could always be obtained.

A NEW GAS ECONOMIZER.

THIS novel device for enriching and economising coal gas is simple and easily applied, and is said to be very efficient. On the top of the liquid-tight vessel there is a dome, from the centre of which a glass tube projects. This tube is closed at the top, and at the bottom opens into the vessel. A float, having a cork bottom, slides upon a tube which enters the vessel at the bottom, and communicates with a pipe leading from the gas meter. In the upper portion of the float there is a shallow chamber which communicates by small perforations with small vertical tubes arranged around the float. From the top of the float a needle extends upward into the glass tube, and serves as an index of the movements of the float. The vessel is provided with a filling tube, through which some of the lighter hydrocarbons are introduced into the vessel. The float rises and falls freely as the depth of the liquid varies in the vessel, but the weight of the float remaining the same its displacement is not affected by the quantity of liquid in the vessel, and the gas ejected into it from the float will always have the same quantity of liquid to rise through, thereby insuring uniformity in both the pressure and the quantity of gas supplied. Gas conveyed to the float through the tube passes into the vertical tubes and rises up through the liquid, and finally passes out through the tube for distribution to the burners.

The gas is enriched by its passage through the hydrocarbon, and the light given by it is correspondingly increased.

This useful invention, the *Scientific American* states, was recently patented by Mr. George T. Strong, of Port Hope, Ontario, Canada, from whom further information may be obtained.

HYDROCELLULOSE IN PHOTOGRAPHY.

M. AIME GIRARD has communicated to the Photographic Society of France the following note on the employment of hydrocellulose in preparing photographic pyroxyline :—"Whenever cellulose ($C_{12}H_{10}O_{10}$), in any form, is submitted to the action of concentrated acids, it is dissolved, and by taking up two equivalents of water is transformed into glucose ($C_{12}H_{12}O_{12}$). But previous to this saccharification, an intermediate stage may be observed, where only one equivalent of water is taken up, and a new compound is formed to which the formula $C_{12}H_{11}O_{11}$ is attributed. This compound, to which I have given the name of *hydrocellulose*, is not soluble in the acids, and provided that care be taken in the manipulation, it still possesses its original external form ; but so soon as it is touched it will be found to have lost all its power of cohesion, and to fall away to an almost impalpable powder. Hydrocellulose possesses a number of chemical properties of its own, but it keeps also some of the properties belonging to ordinary cellulose. Among the latter is its capability of being nitrified by a mixture of nitric and sulphuric acids, and of being by this means transformed into either explosive or soluble pyroxyline. In this way we can prepare either explosive or soluble pyroxyline in the state of a fine powder. The manner of preparing it is precisely similar to that of preparing pyroxyline from cellulose, but in this case the product, when rubbed in a mortar, is at once reduced to an exceedingly fine powder. This powder, dissolved in a mixture of alcohol and ether, gives a collodion whose value to photographers it will be most interesting to ascertain.

The only difficulty, therefore, is the production of the hydrocellulose. This substance can be obtained from any form of cellulose, but the best for the purpose will be found to be raw cotton in tufts. For effecting the conversion there are three ways :—(1) Immersion for several hours in concentrated acids ; (2) exposure to the vapours of the hydracids, as hydrochloric or hydrofluoric acid ; (3) absorption by a weak acid, and then desiccation. Of these three methods the last-named is undoubtedly the most convenient. Take, then, some fine tufted cotton, and immerse it in a 3 per cent. solution of nitric acid ; remove it immediately, drain it, and put it in a cloth and wring it well ; then pull it out and leave it to dry. If you are pressed for time you may dry it on a stove at a temperature of 40 deg. to 50 deg. ; a few hours will in that case suffice to render the cotton quite friable, and its transformation into hydrocellulose will be complete. But care must be taken not to raise the temperature above the point indicated, or the substance will turn yellow and decompose. When, however, time is no object, let the cotton be well pulled asunder, and then be allowed to dry slowly on a plate in the laboratory or studio at a temperature of from 15 deg. to 20 deg. By this, the more preferable method, the cotton will, in a few weeks be converted into hydrocellulose, which, though perfectly friable, will preserve sufficiently its fibrous condition to be easily acted on by the acids that are to nitrify it.

MILK A FORBIDDEN FOOD IN CHINA.

THE Chinese, who esteem rats to be a delicacy, are down on the use of milk. The following translation of a Chinese placard regarding the highly immoral practice of consuming cow's milk is sent to the *Foochow Herald* for publication :—"Strictly refrain from eating cow's milk ! Man should not rob the beasts of their food. Moreover of all beasts the cow is the most useful and meritorious. Men who do not discriminate between mankind and beasts are worse than senseless. Those who sell milk darken their consciences for gain, and those who eat cow's milk foolishly think they are benefiting their bodies. Men who take medicine should first carefully investigate and find out its nature. Why do not those who eat cow's milk consider and inquire into its origin ? For instance, men beget children, and while the children are small they depend upon milk for their nourishment ; so it is also with beasts. But when men buy milk to eat, do they not do injury to the life of the calf ? And is there not bitter hatred and distress in the minds of both cow and calf ? Beasts cannot speak ; how then are they able to tell the man that, in eating the milk of beasts, his body becomes like that of birds and beasts ? But if men wish to take strengthening medicine there are numberless other articles in the world that are beneficial ; and what necessity then is there for taking cow's milk ? Besides this, the death and life of men have their fixed number and limit, and this cow's milk cannot lengthen out and continue the life of man. Since, then, all know the truth—that it cannot do this, all ought to act with loving and benevolent spirit. Especially all who receive this exhortation should keep from eating milk. The children of those who cause their families to refrain from eating milk will be preserved to grow up ; they also will thus lengthen out their own lives, and will escape from evil in time of fatal epidemics. If such persons be able also to exhort others, who are ignorant of first principles, to leave off the eating of milk, their descendants shall surely prosper. Published by the Hall of Good Exhortations. The Xylographic blocks are deposited in the Ung Ling Koh."

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